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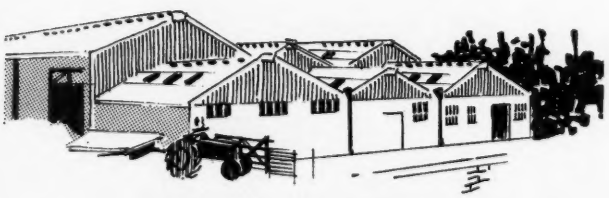

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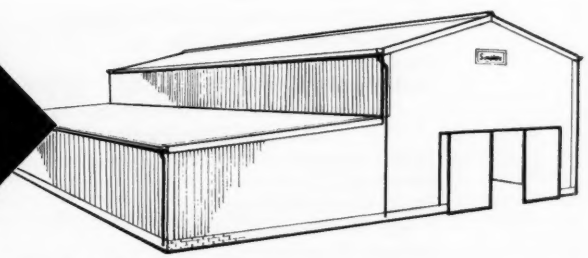

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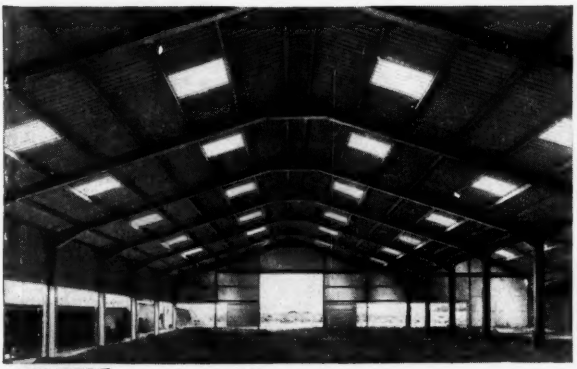

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1894 — 75th ANNIVERSARY — 1969

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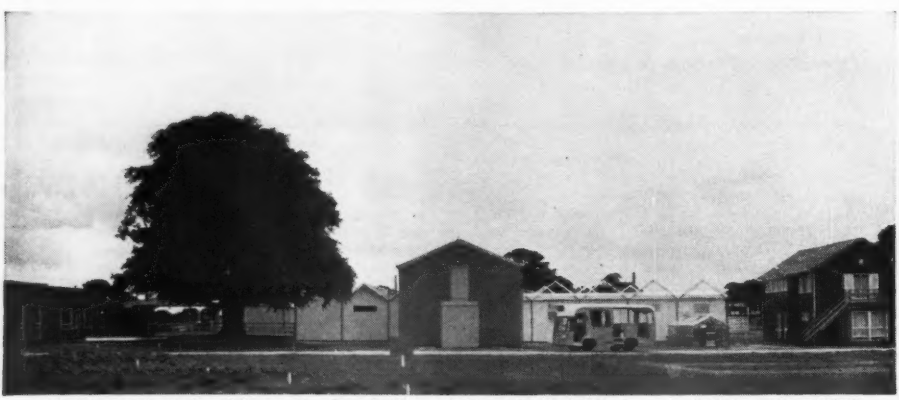

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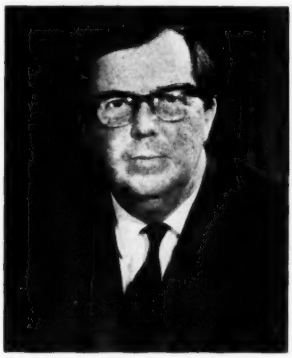


FOREWORD

by

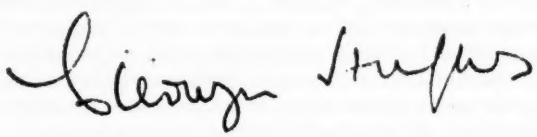
The Minister of Agriculture, Fisheries and Food

THE gentlemen of the Board of Agriculture who modestly launched their *Journal* in September, 1894, would be greatly impressed by the way in which British agriculture has changed—markedly for the better—over the last 75 years and by the partnership which has evolved between Government and all sections of the industry.

In this 75th Anniversary number of *Agriculture* it is appropriate that we should pay tribute to the magnificent progress made by the industry and look forward to the prospects for the future. If, as we are told elsewhere in this issue, British agriculture was 'dead' in 1894, it is certainly very much alive and kicking today. I am convinced that the dissemination of information and advice so tentatively begun by the Board of Agriculture and so successfully continued and developed over the years has played no small part in ensuring this progress.

Like the industry it serves, this Journal, too, has changed since 1894. The staid *Journal of the Board of Agriculture*, regarded as a medium for issuing statistical and other information 'accessible to the Board', has today become a periodical in which many developments in farming are authoritatively discussed and explained. My Department's responsibility for food as well as for agriculture is now becoming increasingly represented by articles which illustrate the welcome collaboration between farmers and food processors and distributors.

I am sure that these great industries will continue to progress and prosper in the years that lie ahead.



Norman Pizer, C.B.E., M.Sc., Ph.D., F.R.I.C.,
Senior Science Adviser for the National Agricultural Advisory Service, discusses the progress of

Science in Agriculture

What is science

SCIENCE serves agriculture in many ways as a method of defining and studying problems, as a creator of new knowledge and an assessor of old, and as a basis for technological development and advancement.

As a method of study, science uses observation, recording and experimentation to establish basic facts which it classifies and correlates to form a general statement. This is then subjected to rigorous and continuous examination and improvement and if found to be invariable is regarded as a law. The laws of physics and chemistry are of this kind. Both living and non-living things, however, are variable, and observations on them are subject to errors. Some situations and systems are simple and others are complex. Variability, complexity and error are studied, using the laws of chance and the techniques of statistics. Mean values and measures of dispersion of data around the mean provide the most useful statistics.

A common method of study in science is to construct a model system which can be studied mathematically and exact relations for it determined. Models are commonly simpler than reality but may bear no known resemblance to it. They are designed to restrict variability or to facilitate its measurement and eventually to provide a means of examining more complex systems or situations.

Application of science on an extensive scale is not possible without a varied, active and efficient technology and this in turn is not possible without effective industries, markets and communications. In some parts of the world where these requirements are all or partly missing, little science is being applied to agriculture, and farming remains almost as it was hundreds of years ago, but in countries where they do exist, farming is based on science and is dependent on highly-developed technologies for its materials and equipment.

Progress in science

Over the past twenty-five years, science has developed and expanded rapidly in all its branches. Much of the impetus and progress has been due to the application on a wide front of highly-developed physical techniques which have revealed the structures and behaviours of living and non-living systems and of their components down to molecular levels of size. Precise instrumentation has made the methods widely available, relatively rapid and partly or wholly automatic in action and, if necessary, the measuring instruments can be linked with recorders and computers.

The basic sciences on which agriculture and the industries associated with it draw for information, inspiration, scientific and technical advancement are the physical, chemical, mechanical, biological and geological sciences in each of which advancement has been rapid. How much of this advancement has influenced agriculture or been incorporated into its sciences and technologies is difficult to estimate. It must be considerable and it is possible to mention only some of the effects of it here.

Dependent basic resources

The basic resources on which agriculture depends are soil, water, crop nutrients and productive crops and animals.

Soils. The main feature of soils is their variability, yet repetition in recognizable forms, which are associated together according to parent geological material, long-term climate and ecological history. For more than forty years, soils have been studied in relation to these factors and a system of classifying them evolved which has world-wide application. The system indicates the derivation of a soil and the main morphological and chemical features of the soil profile. The morphological and chemical features determine water disposal, root range and nutrient and water supply to crops. Hence soil survey memoirs and maps provide a sound basis for assessing the cropping potential of soils, the treatment needed to achieve this and the probable influence of husbandry on soil behaviour. A generalized soil map of the world was exhibited at the 9th International Congress of Soil Science held in Adelaide, Australia, in 1968. It was based on soil surveys in many parts of the world and extrapolations from them. Soil memoirs and maps, on the scales of 1 : 25,000 to 1 : 250,000 are available for parts of the U.K. and are providing a basis for land classification, land capability studies and advisory work on soils. Here, as elsewhere in the world, the potentials of soils are being understood and land use, crop production and soil conservation related to them.

Soil advisers at work during a trial on thin fen peats

Water. Similar world-wide, regional and local studies have been made of water resources and the origin, composition and contamination of water supplies. Watershed studies of precipitation, evaporation, transpiration, runoff, percolation and salinity are being made to provide a basis for research in water management and for increasing the amount of usable water for crop production. The physics of evaporation of water from soils and trans-

piration from crops has been studied and combined with meteorological data to provide a scientific basis for irrigation practice. The growth, yield and composition of crops in relation to water supply forms a considerable field of research in plant physiology with application to the tolerance of crops to water stress, soil water measurements and irrigation practice. The damaging effects of too much water in soils and untimely cultivations are apparent in places in most seasons, but were extensive and severe in 1968 and 1969. The theory of retention and movement of water in saturated and unsaturated soils and knowledge of the effects of water on soil consistence and soil structure are adequate to explain what has happened, but the variability of soils complicates situations and limits quantitative assessments of causes and effects.

Crop nutrients. Crop nutrients have been studied more than any other aspect of soil fertility with a view to understanding the manner of their occurrence in soils, availability to crops, entry into roots, movement in plants, and their effects on crop metabolism, composition and yield. It has long been known that soils are unable to sustain productive and remunerative crops without nutrients and conditioners being added to them. The main nutrients that require to be added to soils are nitrogen, phosphorus, potassium, calcium and magnesium. The supplies of all these seem to be safeguarded for many years to come: nitrogen through improvements in the chemistry and technology of production of ammonia, ammonium nitrate and urea; potassium and phosphate through the discovery of further extensive deposits; calcium through its relative abundance in chalk and limestone; and magnesium through its association with calcium and potassium and the existence of technological processes for the manufacture of its more important salts.

The fertilizer industry supplies these nutrients singly or in combination to suit different crops and situations, and in physical form to facilitate storage, distribution and availability to crops. These most important requirements in fertilizers have been achieved by intensive study and application of chemistry, physics, technology and marketing to the production of fertilizer formulations from available raw materials. The formulations are based on studies of crop nutrition and soils and countless manurial experiments on the responses of crops on different soil types, in different seasons and in different systems of husbandry. The evidence has been summarized for advisory use and arranged to meet possible developments. The increasing use of fertilizers, however, and the range of their potential use on grassland, which for individual fields extends from nil to 600 units of nitrogen per acre, will need continuous experimentation with them and monitoring of their effects on crops and soils.

Trace element deficiencies—boron, manganese, copper, iron, zinc, molybdenum and cobalt—are important in some areas, and satisfactory treatments are available, except for iron deficiency. More needs to be known about rates of removals of trace elements from soils, their availability to crops, the effects of excesses, natural or added, and additions coming from the environment.

Crop improvement. Improvements in crop performance, quality and production are due to many causes—better knowledge of the potential of crops, crop nutrition and physiology, better protection of crops against pests and competition from weeds, and improved methods of husbandry—but basically to the work of plant breeders in selecting and crossing promising lines or varieties and establishing improved 'pure lines' from their descen-

dants. Improvement due to hybrid vigour can be considerable and shows itself in a number of ways: response to light and other environmental factors, relative development of parts, rate of growth, quality, resistance to diseases or insects, and yield; pests may later break down resistance to them. The vigour of hybrids is greatest in the first generation after a cross and thereafter declines. Methods are being sought and developed for mass production of suitable first generation hybrids. They have already been successful with corn and sorghum and promise to be successful with wheat.

Animal improvement. Considerable scientific effort is being put into the improvement of livestock. The pattern is similar in all countries where research is active. Genetic improvement is being sought by selection within pure breeds for a limited number of desirable traits which may be prolificacy, growth rate, weight and quality of produce, efficiency of food conversion and reaction to environment, and by cross breeding followed by selection. Developments in chemistry, biochemistry and analytical methods are being applied to studies of the nature and composition of plant tissues at different stages of growth and of the changes occurring when plant tissues are conserved and stored. Similar related studies are being made of processes of digestion and absorption, the composition, structure, metabolism and function of animal tissues, their requirements for optimal performance and the nutritional requirements of the whole animal at different stages of growth and performance. Animal diseases and parasites are receiving similar intensive study.

The animal husbandry to which research is being applied varies in nature and intensity from hill-grazing at low stocking rates to intensive grazing of heavily fertilized pastures and leys, to feed lots where large numbers of animals are housed together in one unit and handled with varying degrees of mechanization and automation. Profit margins may be small and, among other things, depend on control of food intake at or near optimal level, which is determined by the costs and nutritional qualities of the food ingredients. Monitoring of the composition and quality of foods may be an important requirement of extensive and intensive systems of animal production. Much more needs to be done to evaluate the nutritional qualities of concentrates and roughages in individual situations. All foods are variable. The protein of cereals can vary in amount and quality according to season and locality. Grass and roughages can vary much more, particularly in the amount of indigestible fibre, through maturity or loss or destruction of the more valuable plant parts.

Plant regulation. Five classes of natural plant hormones have been distinguished and their effects on plant growth studied. They are the auxins, the gibberellins, the cytokinins, the abscisic acids and ethylene. In addition, a number of chemical compounds have been synthesized with a variety of physiological effects on plants and are available commercially. Together they provide an array of chemicals potentially able to stimulate or control crop growth to give optimum yield of commercially valuable produce or to inhibit or destroy weed competitors. Their importance to plant physiology and crop production is considerable, but it is beyond the scope of this article to do more than mention some of their effects which have found practical application. They are (1) root initiation and development, valuable for promoting rooting in cuttings of woody plants, (2) control of dormancy in seeds and buds, valuable for breaking dormancy when growth is sought or

inhibiting bud-break in stored products such as bulbs and potatoes, (3) control of vegetative growth and form which could have value in relation to cultivation and harvesting practices, (4) control of flowering time and intensity, (5) fruit set and enlargement, (6) ripening and senescence of fruits, (7) abscission of fruits, (8) tolerance to low temperatures and water stress, (9) efficiency of photosynthesis, (10) the composition and properties of crop products, and (11) the selective destruction of weeds. The development and use of herbicides is the best known and most extensive application of the plant growth regulators.

Crop protection. A wide range of chemicals is in use for the control of crop pests. The subject has a long history and has become a matter of public interest and controversy. Investigation is concerned with (1) mode of action, (2) least effective dose, (3) formulation, (4) timing and method of application, (5) tolerance of the crop, (6) persistence of the pesticide, (7) hazards to beneficial insects, wild life and man, and (8) nature and fate of breakdown products and residues. Again, the subject is too big to cover here. The place and effectiveness of chemical control of crop pests depend on detailed knowledge of their life histories, the time when their attack on plants is most damaging, the weather at the time, their build-up under systems of crop husbandry, the extent of the damage they do and the cost of treatment in relation to the value of the crop. These are matters of continuous study, and decision on whether to use chemical control may rest on local and regional evidence of build-up and forecasts of future development. Wherever possible, changes in husbandry practice are part of pest control. Where predators on pests are known to be harboured by weeds, complete elimination of the latter is not advisable. The introduction of predators to control a pest is only successful where conditions are favourable to its rapid multiplication and predators on it do not occur. The most successful applications of biological control in Britain have been the introduction of predators into glasshouses for the control of white fly and red spider on peaches, tomatoes, chrysanthemums and cucumbers.

Research is adding to the knowledge of the kinds of pests attacking crops and of their significance. Important among these are the nematodes and viruses which have become special studies in research and advisory work.

Moulds. The study of moulds and other micro-organisms on stored grains, forage and litter, and in the environments of farm buildings, particularly those housing intensive livestock, has developed rapidly in recent years. Attention has been given to identification of micro-organisms, environments affecting their development, their effects on crops conserved and stored on farms, and the effects they and their metabolites may have on the well-being of livestock. The future value of these studies is likely to be considerable.

Effluents. Intensive husbandry results in intensive waste production as crop wastes, animal wastes and manures. The treatment and disposal of these wastes and manures have become an important problem. After processing have they any value as food for other livestock or must they be treated by microbiological digestion processes, and a relatively innocuous residue returned to the land? The problem is primarily one for microbiologists, chemists and engineers to solve. That part of the effluent that enters land drainage and discharges into streams and rivers must satisfy the chemical and biological standards of river authorities. Scientific studies of the problems are being planned but have hardly begun.

Sir Gordon Cox, K.B.E., T.D., D.Sc., F.Inst.P., F.R.I.C., F.R.S., Secretary of the Agricultural Research Council of Great Britain, discusses the progress and prospects of

Agricultural Research

THE state of British farming and horticulture when 'Agriculture' celebrates its centenary will depend upon many political decisions taken in the next twenty-five years, upon the complex play of economic forces, and upon the scientific and technical knowledge available to farmers and growers. The greater the amount of scientific knowledge, the more possibilities there will be for the farmer to operate, efficiently and for the greatest benefit of the consumer, within whatever framework economics and politics may impose upon him. In order to plan research it is not necessary to know what that framework will be; no matter what the relative importance of (say) cereal growing and cattle raising may be we will certainly need to know how to get the most out of an acre (or should we say hectare?) without impoverishing or contaminating the land, how to increase the fertility and productivity of animals without cruelty, and so on. Nevertheless since resources are not unlimited, and priorities therefore inescapable, it is necessary to have clearly defined objectives. On the advice of a working party set up in 1966 the Agricultural Research Council decided upon two guiding principles: first, to base the planning of all objective research on the assumption that Britain will require at least twice its present net output of home-grown food in thirty years' time; and secondly, to ensure that in research, as in farming, the seed corn is not eaten—in other words, not to make the mistake of directing all resources to the investigation of today's problems, but on the contrary to ensure that adequate support is given to 'speculative' research, so that the seminal ideas on which the future advancement of the agricultural sciences depends can grow to fruition.

The decision to base planning on an assumption of doubled home output of food—a decision that is wholly compatible with the shorter-term import-saving objectives put forward by the Economic Development Committee for the Agricultural Industry—has been criticised as being no more than a statement of the obvious. That it is not, in fact, a superficial statement can be seen as soon as its detailed consequences are examined, but a point worth making here is that it emphasizes the Council's concern with *food* on both sides of the farm gate; it accepts implicitly that the problems of maintaining the quality and reducing the waste of produce after it has left the farm have an equal claim on our attention with the problems of production.

How difficult will it be technically, to double output? In the last fifteen years, gross agricultural output at constant prices increased by more than 40 per cent; the productivity increase was much greater because during the same period the total labour force employed declined by about 45 per cent. This great achievement by the farmers and their advisers has depended very greatly on the results of research. For example, the 27 per cent increase in cereal yields over the period can be attributed partly to the introduction of improved varieties—of which Proctor barley introduced by the Plant Breeding Institute, Cambridge, is an outstanding example—and partly to the more effective use of weed-killers. The even greater increase—over 70 per cent—in meat production owes much to the development of artificial insemination techniques and to new feeding methods developed by the Rowett Research Institute and the National Institute for Research in Dairying. The increase in average milk yield per cow from about 600 gallons twenty years ago to nearly 850 gallons today is the combined result of artificial insemination techniques, the application of quantitative genetics, and improved knowledge of nutritional requirements.

Important advances have also been made in the control of diseases of both animals and plants. Increased milk production owes much to improved control of mastitis based on work at the N.I.R.D. in collaboration with the M.A.F.F. Veterinary Laboratory, while recent research at the Institute of Research in Animal Diseases is expected to result in a 90 per cent reduction in the incidence of milk fever. It is probably no exaggeration to say that the broiler industry and indeed the intensive rearing of poultry could not have been developed without the present highly efficient anti-coccidial drugs, in the screening and testing of which the Houghton Poultry Research Station played a leading part. More recently research at Houghton has established the causal agent of Marek's disease which is estimated to cause losses in poultry amounting to about £10 million annually, and it now seems likely that, as a result of this work, the pharmaceutical industry will be able to produce an effective vaccine against the disease.

On the plant side, new methods of freeing nearly all perennial fruit crops and potatoes from virus disease have led to substantial increases in the yield and improvements in quality. For example, virus-free King Edward potatoes have been found to out-yield infected stock by 10–15 per cent.

Sugar production in this country, which was about 500,000 tons in 1950, had by 1968 risen to 935,000 tons, an increase in yield of over 80 per cent. This reflects the application of many different kinds of research leading to the introduction of better varieties, improved manuring, and better control of pests and disease. In some years the most important single factor has been the control of yellow-virus. In 1959 experiments at Rothamsted Experimental Station showed that spraying the sugar beet crop could give a profit to the growers of more than £500,000. The 1959 results were so spectacular that if research had stopped at that point probably all the crops would have been habitually sprayed in later years as a precaution. This would have been wasteful since further research enabled predictions to be made of the likelihood of attack, and now a spray-warning scheme operates which not only enables virus yellows to be controlled in the areas in which the attack is likely, but avoids the cost of spraying in areas where it would not produce an economic return.

The discovery at the N.I.R.D. of the naturally-occurring antibiotic Nisin in milk has led to its use commercially in preventing spoilage of an enormous

tonnage of cheese and other foods; and this discovery hints at the possible existence of a range of food preservatives that may be as revolutionary in their action as an antibiotic is in the medical field.

These are some examples of what has been achieved. The same overall growth rate, maintained for thirty years, would indeed double the gross output. But, apart from the fact that the law of diminishing returns must operate to some extent, the pattern of agriculture will change: in consequence more than doubling will be called for in some sectors and less in others. It is rather unlikely, for example, that it will be thought wise to attempt to double beet sugar production in Britain by the end of the century, but it might be thought desirable to treble cereal output, if that were possible. However, as long as any crop is a significant one in this country, maximization of productivity will be important, and for this reason research on it will continue to be necessary although priorities will change. In the case of sugar beet it is easy to see that, even if research made a very substantial increase in productivity possible, there might be good economic and political reasons for not increasing production; in another case it might well be that research could show the way to throwing off economic restraints that had hitherto limited production. It is the business of those concerned with the assignment of research priorities to assess the prospects in all these different situations, and especially to consider how scientific ideas, often in an embryonic state, can be developed and applied to the improvement of food production.

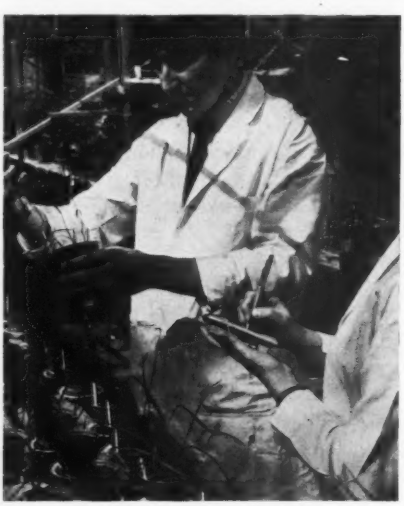
It is impossible to summarize in this article all the considerations that should guide the planning of future research, but some trends can be noted. It is clear that specialization and intensification, made possible by past research, have come to stay and are creating many new research problems which are broadly of two kinds. In the first place, it is necessary, as the White Queen said, to run faster in order to stay where you are—the obvious example is the intensification of disease problems. Secondly, not only do the side effects of specialization and intensification obtrude themselves more and more on the non-farming inhabitants of this predominantly urban country, but non-traditional methods of farming may be having long-term effects on the land that are not yet understood. Accordingly, hand-in-hand with research to make farming more efficient in the narrow sense must go investigations to ensure that it is neither offensive to its neighbours nor creating for itself long-term problems of soil fertility.

Of the many scientific developments likely to influence agriculture in the next thirty years only a short and rather arbitary selection can be made here. It has been estimated that without cultivated plants this earth could sustain only about 35 million people, and in the long run nothing is more important than the improvement of food crops. It is therefore encouraging to see that cytogenetics and other sciences are contributing substantially to the development of plant breeding. For example, it is now possible to remove the walls from single cells by enzyme treatment to give naked protoplasts. It may be possible, by the fusion of such naked protoplasts, followed by the regeneration of whole plants, to produce hybrids that could not be obtained by other means, and thus, for example, introduce into a crop plant useful yield and resistance genes from an entirely different species. Again recent successful experiments in the culture of pollen grains to produce whole plants open up the possibility of obtaining stable populations of economic plants, especially

intergeneric hybrids, in three or four years instead of the fifteen or so required by conventional plant breeding methods.

A better understanding of plant physiology would enable us to give better specifications to the plant breeder. For example, the potato crop reaches its maximum haulm production about three weeks after midsummer's day. This means that, in terms of its efficiency as a photosynthetic unit, the potato plant is not highly successful and we ought perhaps to select and breed potatoes that will reach their maximum haulm production around midsummer's day, so that the best use is made of seasonal light energy. Some of the research now being done on seasonal variation in leaf growth, assimilation, and distribution of assimilates in the plant will promote our understanding of the regulation of plant development and eventually provide the guidance for breeders to produce varieties that exploit the potential of our soils and climate more fully.

In spite of the great advances that have been made in crop protection we still lose a large proportion (sometimes set as high as one-third) of our potential crop yields because of pests and diseases. Although important advances in crop protection continue to be made on an empirical basis, it is reasonable to expect that before long we shall achieve an understanding of the mechanisms of insecticide and fungicide action, and also of natural plant resistance; the way should then be open for the development, on a rational basis, of new and more effective systemic fungicides and pesticides. In parallel with these developments we may expect further advances in biological control and also the development of the so-called 'third generation insecticides' based upon a better understanding of the structure and function of naturally occurring substances such as pheromones and toxins.



Pesticides being given preliminary tests under controlled conditions in the glasshouse

A relatively new field in the animal world is gnoto-biology, the study of animals in a germ-free condition or infected with known micro-organisms only. With the techniques of gnoto-biology it is possible to study a particular disease without the complications arising from the presence of sub-clinical

infections of other pathogens. It is also possible to explore the limits of growth potential in particular animals that have no disease defects. It has already been shown that minimal disease pigs can be brought from birth to a size suitable for slaughter in 145 days instead of the usual 185 days, and also that the food conversion ratio can be as low as 2·8, compared with the average 3·2 (which itself is considerably lower than the figures prevailing before the introduction of antibiotics and copper as food additives).

Since protein is the most expensive constituent of animal diet, the search for alternative sources of acceptable quality is likely to continue unabated. Microbial protein grown on industrial wastes, petroleum etc., will call for a good deal of evaluation to determine its field of usefulness: at present one of the difficulties seems to be that the cell walls are not easily digested so that access of the digestive enzymes to the cytoplasmic materials within is restricted. The development of high-protein crops by the plant breeder will no doubt continue to yield useful results, and it will be interesting to see whether exotic crops such as soya can be modified so as to compete successfully in our climate with native crops such as barley and field beans. Another possibility is the breeding of entirely new types of plants such as the experimental hybrid, raphanobrassica, developed at the Scottish Plant Breeding Station by crossing fodder radish with kale to produce a leafy fodder crop.

In the field of animal reproduction batch parturition based on the suppression of oestrus, already successfully applied in the pig and sheep, will no doubt be extended and perfected so that the technique can be used with cattle. It may also become possible to compute accurately the dose of hormone required to produce a given number of foetuses. In sheep this could make a significant contribution to economic efficiency; it has been claimed that up to four viable lambs could be produced provided the dam could be fed in accordance with the number of foetuses she is carrying. The technique of transplantation of fertilized ova has shown its potential as a short cut to stock improvement and the success achieved in sheep may be extended to other species, provided the problems of intracervical implantation can be overcome.

Agriculture in this country has been well served by research in the past. One of the reasons why we can be confident that it will continue to benefit from research in the next quarter of a century is that there has been adequate encouragement in the agricultural research service for far-seeing scientists to generate ideas that were not immediately 'useful' but which have, so to speak, been undergoing incubation to produce the next generation of practical applications. Maybe a few of the eggs will be addled, but some sturdy chicks will emerge. Communications between farmers and research workers, thanks to the N.A.A.S., are in the main very good, and when we are inclined to think otherwise we should perhaps remind ourselves of the need for an incubation period, even for ideas that look 'practical' from the start. Not long ago a distinguished scientist suggested that if the results of research on fertilizers at Rothamsted were properly applied, at least £4m. a year could be saved on the manuring of cereals alone, without any loss of yield. I rather hope that in twenty-five years' time someone else will be making a similar comment on some other topic: it will at least show that the agricultural research service has not run out of ideas.

Acknowledgment

This article is based on material provided by a number of colleagues to whom I wish to express my gratitude

Will the final result of investment in food research produce better and safer foods at a reasonable price? Dr. A. W. Holmes, Director of the British Food Manufacturers Research Association gives his views on

Food Research

It is said that 90 per cent of all the scientists who have ever lived are still alive today, a statement which, perhaps, explains why the pace of technological change is greater today than ever before, a change which has a direct impact on our lives. In the early 50s there was the first cross-channel, black and white television programme—a picture of very mediocre quality—and less than twenty years later we are able to look forward to live colour television direct from the surface of the moon. This is a dramatic advance, the outcome of intensive and massive scientific and technological research.

The total research effort on food is infinitesimal compared with that in the space and electronics industry but, even so, very significant changes have

occurred. Some changes are dramatic, but some are the cumulative effect of research effort spread over many years. The increase in agricultural production, for instance, is the result of better varieties, better fertilizers and sprays, better machinery, better techniques, etc., all the outcome of continued research effort.

Part of this research is by industry, who in the end, hope to improve their competitive position resulting in improved financial returns. Alongside this there is considerable research financed from public money. This is largely through the medium of the Agricultural Research Council, and in many cases is devoted to longer term, more fundamental (but nevertheless vital) studies than those carried out in industry.

The total effort on food research is, however, heavily biased to the primary production of food. There are many reasons for this, mainly historic. Partly there was the desire to ensure that we were as self-sufficient as possible, especially in time of war, although the balance of payments problem may now be of greater immediate significance. In addition there was only a limited interest in pre-packaged ready prepared food. Essentially the housewife took the primary produce and carried out all the food manufacturing processes herself.

The food industry today is very different from even ten years ago. An increasing proportion of our food is processed in some way. One has only to think of the change from fresh peas to frozen or sophisticated dried peas which has occurred, from fresh potatoes to dried potatoes which is occurring, and from joints cut up by the local butcher to the provision of pre-packed joints from the meat factory which will occur. These changes, which contribute to the well-being of the country, are the outcome of research.

As with agriculture, some of this is carried out by individual companies, often highly sophisticated research at a high intensity. Unilever Food Research Laboratory at Colworth House is among the best in the world. There is, however, no equivalent to the publicly financed ARC laboratories for manufactured food research. The closest approach is the research associations. Research associations differ from ARC laboratories in being primarily geared to industry which provides the main bulk of the finance, although there is a substantial financial contribution from the Ministry of Technology. The size of the latter contribution depends on the income from industry and, while the actual magnitude is in many cases increasing, it is the policy of government that the proportion of public money involved should gradually decrease.

A research association carries out research on behalf of its members who usually represent a substantial proportion of the industry. The research programme is devised in consultation with the industry and generally deals with the major problems of long-term significance and of widespread interest. In addition, research associations provide specialist information and advisory services and, in some cases, carry out confidential work on behalf of a particular company.

There are three research associations serving the food industry. Each of them deals with a different aspect of the industry, with close co-ordination of the overall research activities. The Fruit and Vegetable Preservation Research Association is situated at Chipping Campden, Gloucestershire, and deals with the problems of canning and freezing and drying of fruit and vegetables. It was from these laboratories that the Campden Tablets used for

fruit preservation during the war emerged. This, however, was a minor activity; the main emphasis was put on helping the industry to maintain the high standard of canned fruits and vegetables when the basic principles were less well understood than they are today. The Flour Milling and Baking Research Association has recently been formed from its two parent research associations which were individually concerned with flour milling and with baking. The name clearly indicates the main areas of activity. The most outstanding achievement here has been the discovery of the new process for making bread, 'The Chorleywood Bread Process', for which the research association was given a Queen's Award. The remaining food manufacturing interests are covered by the British Food Manufacturing Industries Research Association. This involves a very wide range of commodities covering such diverse items as meat, confectionery, chocolate, pickles, jams, oils and fats, etc., and a subsequent article will describe its current activities in more detail. Suffice at this time to say that the work ranges from quite fundamental biochemistry through the application of the results of this work to particular commodities, to new process development and control. It has a long history of successful service to industry ranging from pre-war achievements in preventing bloom formation on chocolate, to the post-war development of a new process for pickles and, very recently, a new method of manufacturing chocolate.

A further source of research information is the universities. Some universities have departments of food science or food technology and associated with these schools are many active research departments. Research in these areas is by its very nature of a wide ranging fundamental character, and one problem which faces all food manufacturers is applying these results to their activities. Here again the research associations have a vital role to play in bridging the gap.

What are the general problems facing the food research workers today? They may be classified into four broad categories.

Supplies. There is an increasing awareness by food scientists of the critical problems which the world is facing, problems which will become more acute as the years progress unless something drastic occurs. Protein deficiency is a particular concern because of the significant effect which this has on mental development and growth, particularly in the very young. It is not simply a problem of distribution and utilization. It has been found that some populations will go short rather than eat unfamiliar foods probably because they do not know how to use them. This is primarily a problem in under-developed countries, but serious consideration must be given to the impact in developed countries and the effect of world resources on the availability of food in this country. For instance, recent events in Africa have affected the supplies of palm kernel oil.

Convenience foods. This is a rapidly growing market whose growth is in response to the demands of the housewife and which presents many problems in storing and packing. Alongside this work on convenience foods new processing techniques are being discovered which will allow the production of new and better products. One can think back to bottled coffee to see the sort of thing that can happen. Bottled coffee was displaced by spray dried coffee which is gradually being taken over by the newer freeze-dried coffee, but there is no reason to believe that this is the end of the road and that other still better forms may not be available in the near future.

New processes. Many of our basic food processes in current use today are simply developments of the traditional kitchen method, and are often based on purely empirical observations. They are frequently time consuming and expensive in power, space and use of materials. Scientific research has allowed, in some instances, radically new processes, but this change is just beginning and within the foreseeable future the methods of the manufacturing of many foods will drastically alter without the housewife appreciating that any change has taken place. The benefit to her will be that she will be able to obtain a consistent product at a more reasonable price.

As the basic principles involved in food manufacture are understood it is becoming possible to apply automatic control techniques to processes with benefit in the quality of the product and, more importantly, in the saving of expensive labour.

Safety. While the popular press may give the impression that the main aim of food manufacturers is to poison the public by the addition of large amounts of noxious substances, this is obviously completely absurd. The manufacturer is increasingly concerned that his product should be completely safe and is devoting a very large research effort to this end. The problem is a rather complex one. The hazards which are easiest to control are those which could arise from the deliberate addition of materials intended to aid the general acceptability of the food or prolong storage life. This covers materials such as colours, flavours and preservatives, without which many of our foods would be very much less acceptable. Here the problem is fairly straightforward. If the materials added are safe and they are added in reasonable amounts, the food produced will be safe for the consumer.

A more difficult situation, however,arises with the possibility of microbiological deterioration occurring during the prolonged storage periods which are now required, and intensive effort is being devoted to the better understanding of the processes which allow microbial growth under adverse conditions. The food manufacturer is, however, very conscious of the problem and most operate at very high standards of hygiene so that the problem is minimized.

There is, of course, always the possibility of the unexpected happening and a process which has been well established and operated over many years may well present an unforeseen hazard. For instance, food has been smoked for hundreds of years but it is only in the last few decades that a potential danger from this process has become apparent. Whether this is a real danger or not remains to be seen. Equally, the possibility of aflatoxin (a poisonous substance produced by a particular mould) appearing in human foods only became apparent when the difficulties with animal feedingstuffs were encountered. It is fortunate that in general the bacteria and moulds which render the food unacceptable grow at a much more rapid rate than those which could cause a potential hazard so we have an in-built safety factor.

What will be the final result of investment in food research? It will be better, safer, more convenient foods, made available at a more reasonable price, to the benefit of the whole community. Such an investment is well worth while and it is suggested that serious consideration should be given to whether an increased research expenditure in this field would not pay handsome dividends.

John Reid, C.B., M.R.C.V.S., D.V.S.M.,
Chief Veterinary Officer for the
Ministry of Agriculture, Fisheries and Food,
discusses the progress and prospects in

Animal Health

WE are living in an era of continued expansion of livestock production, the pace of which accelerates year after year under the pressure of an increasing demand for animal protein by an increasing population in a more prosperous society. The expansion has been conditioned by the necessity to limit costs of agricultural products and this has led to a decrease in the number of farm units, and to an increase in the number of livestock kept on them with a steadily decreasing number of stockmen. This is the background to any current review of Animal Health in this country, and it is valid to say that without good control and in some cases, eradication of the diseases of economic importance, it is doubtful whether the growth of the livestock industry in general and the emergence of intensive units in particular would have been possible.

If we review progress since the early fifties we find an encouraging record. The virtual eradication of bovine tuberculosis on 1st October, 1960, in a country in which the disease had been widespread in the national herd since the nineteenth century, must for ever remain a major achievement in which the livestock industry, the practising veterinary profession, and the Agricultural Departments all shared important responsibilities. Dairy cattle in particular now have a longer productive life. Losses from the disease—both of animals and meat have practically disappeared. An important element of this success has been the enormous benefits to public health. Before a decision was taken to tackle the problem on a national scale, 2,500 deaths from tuberculosis of bovine origin in which the infection was acquired by drinking milk from infected cows, occurred in the human population. This public health hazard has disappeared. It is of interest that cases now

occur in which the infection of cattle has come from a human source. But eradication as applied to a bacterial infection to which more than one animal species is susceptible is a relative term. Currently four animals in every 10,000 submitted to a routine tuberculin test are disclosed as positive reactors but in more than half of these no evidence of tuberculosis is found.

Much effort has been directed to the preparation of tuberculin and its application as a method of diagnosis; further work is required to obtain greater specificity and accuracy.

An important and more recent advance has been made in the eradication of swine fever. This disease, caused by a virus to which only pigs are susceptible, had been recognized in Great Britain for over 100 years and was endemic throughout the country, particularly in areas of heavy pig population and caused losses of the order of £1m per year to the industry. The threat of infection was ever-present to pig herds of all sizes and was a limiting factor in the emergence of the large breeding and fattening units which are commonplace today. The disease had been notifiable for many years and the official policy of control consisted of quarantine measures in the infected premises, and isolation of pigs which had been in contact with infection. Immunization with an inactivated vaccine had been encouraged but was not widely accepted. The great difficulty in dealing with swine fever in every country which has attempted to control it, has been in accurate, speedy diagnosis. Before beginning the eradication scheme in March, 1963, an arrangement was made to ensure that the Ministry's Central Veterinary Laboratory was equipped and staffed to direct all its sophisticated methods to ensure that diagnosis in cases where typical symptoms and post-mortem signs were not presented, could be undertaken with unfailing accuracy.

In the next three years in an intensive campaign, the closest liaison was achieved between the different sections of the Animal Health Division and this, along with the full co-operation of owners and veterinary surgeons, brought the major award of the complete eradication of swine fever virus from the pig herds of this country in June, 1966. It was necessary to slaughter over 400,000 pigs and the cost was approximately £5,500,000. Maximum precautions are taken to ensure that infection is not re-introduced in imports of fresh and refrigerated pigmeat.

The removal of swine fever virus from the national pig herd led to the introduction of a Pig Health Scheme in 1967. This is an application of preventive medicine which in its early period is limited to herds of high genetic potential. Piglet mortality and infections, particularly those of young pigs, will be investigated and studied by the owner's veterinary surgeon and specialists from the Ministry. Methods of control and, where possible, eradication will be sought.

Notable advances have been made in the field of poultry diseases. Pullorum disease has been eliminated from breeding flocks in the Poultry Health Scheme, operated in England and Wales and in Scotland and because a very high proportion of the day-old chicks distributed throughout the country are provided by these flocks, great benefits accrue to the commercial poultry industry. Newcastle disease (fowl pest) had been a major scourge since it was introduced in imported poultry carcases in 1947. A concerted effort to eradicate it by a realistic policy of slaughtering infected flocks accompanied by control of the movement of poultry both locally in districts and nationally was defeated by the rapid growth of the table chicken industry

in the late 1950s. The policy was changed to one of voluntary immunization by the use of an inactivated vaccine. The success of this policy, because it has been so widely supported by the industry, has been spectacular. Nearly 75 per cent of the poultry in England and Wales are now vaccinated and the incidence of the disease has been reduced from over 3,000 outbreaks in 1962 to fewer than 100 in 1968.

In the last decade statistical surveys have been made of the incidence of disease and losses in livestock, including the causes of wastage in the British dairy herd, of calf wastage, and the survey of brucellosis in the national dairy herd, and have helped to prepare the way for future programmes to which the resources of veterinary science in this country must be inevitably directed.

Following the eradication of the major epizootic diseases, brucellosis of cattle is probably the only disease of nation-wide economic importance which can be eradicated. In April, 1967, a start was made through a national voluntary scheme to register as brucellosis-free the herds which could qualify—estimated at approximately 25–30,000 in the survey. The departments assist owners by arranging for the collection of milk for preliminary tests in dairy herds and carrying out an exploratory blood test in beef herds. The conditions which stockowners have to comply with are onerous, including adequate isolation of the unit from herds not in the Scheme, notification of premature births, and stringent conditions on new additions to the herd and animals returned from agricultural shows. Compensation is paid for animals which are shown to be infected at 'official' tests. The very great difficulty in making fast progress in this country is caused by the fact that the clinical disease has been controlled by immunization in a Government sponsored and subsidised Scheme, by using Strain 19 vaccine, which in itself causes animals to give positive results to the standard blood tests. The disease caused such heavy economic losses that vaccination was readily accepted in

A healthy dairy herd of Friesians grazing long ley

the 1940s, and indeed this policy was successful in reducing abortions to a level which was economically acceptable. Vaccination with Strain 19 continues and this will be necessary for some years but its use is now limited to female calves between three and six months of age; this ensures that when the animal reaches breeding age it will no longer carry antibodies which interfere with tests which are applied to the milk or to the animal. When a sufficient number of herds has been entered on the Register to ensure a supply of brucella-free cattle as replacements for herds which are being cleaned up, it will be possible to proceed to more rigorous eradication measures. In the two years in which the Scheme has been operated over 4,750 herds have been registered, they contain over 450,000 cattle, and it is estimated that by the end of 1969, 6,000 herds will have been officially cleared of infection.

In any examination of progress in veterinary science, one must take account of foot-and-mouth disease. Some of the aspects of the 1967/68 disastrous outbreak in this country have already been the subject of a Report by an independent committee, and the risks in this country, which has to import part of its meat supply, have been critically examined. The recommendations by the committee to reduce these risks to a very low level will be fully in operation in October, 1969. It is important in examining the world foot-and-mouth disease situation to record the very great improvement in Europe: epidemics on the Continent, particularly in the countries across the Channel, have always increased the risks of infection being carried by wind or birds to Eastern and Southern England. Many countries which were ravaged by the disease in the 1950s have either eradicated it or have reduced it to a very low incidence. Some of these countries have a routine annual vaccination policy; when cases are confirmed the infected herds are slaughtered and further vaccination is applied in the areas with control of the movement of susceptible animals. This work has been greatly stimulated by the international organizations, notably the European Foot-and-Mouth Disease Commission of the Food and Agriculture Organisation, in which this country has played an important part. The greatest example of the success which this group action can achieve was evident in the early 1960s when two successive waves of types of foot-and-mouth disease virus, which were exotic to European countries, and against which none of the vaccines used would have offered any protection, moved from the Near East and caused widespread disease in Turkey. The European Foot-and-Mouth Disease Commission was able to arrange for the provision of technical and financial aid from the member countries and for supplies of the appropriate vaccine. On each occasion the spread of the epizootic was brought to a halt.

Research into animal diseases is carried out at a generally acceptable level, having regard not only to the provision of funds but also to the availability of scientists to do the work. In the last decade the great advances in virology are reflected in the work on animal diseases. The development of sophisticated methods of isolating viruses in tissue culture has led to a competent analysis since 1960 of the types of virus associated with respiratory disease in calves. Para-influenza viruses and infectious bovine rhinotracheitis virus was shown to be present in cattle in Britain; other viruses were found for the first time as causes of disease. Respiratory infections of cattle in modern intensive systems present a great economic hazard to the industry and the discovery of the agents which cause them is the preliminary to the search for methods of control which are practicable and effective. The cause of transmissible gastroenteritis—a disease of young pigs—has in recent years been discovered

by the virologist and work proceeds to find whether some form of immunization can be discovered to control the clinical disease.

In 1960 outbreaks of a previously unknown disease caused a high mortality in ducks and turkey poults. An intensive research effort was directed to it and the disease was found to be associated with the presence of groundnut meal in the rations. Methods of extracting the toxin and assaying its activity by biological tests were developed which resulted in the cause being defined and measures being recommended to ensure that groundnut meal, free from toxic effects, could be marketed by the animal feedingstuffs industry.

In parasitic diseases, advances of inestimable value in their practical application have been achieved. A mathematical relationship has been deduced between climate and the incidence of liver fluke in sheep and cattle and it is now possible to forecast the disease incidence with reasonable accuracy, and to allow farmers to anticipate the situation and to take preventive measures. This meteorological approach can be extended to other diseases and presents an interesting area of motivated research.

Research in parasitic gastroenteritis has led to a greater understanding of the degree of contamination of pastures in the spring, and the increase through grazing by young calves, initially only lightly infected, until the burden becomes too heavy and by August serious outbreaks of disease are experienced. Several simple grazing procedures have been devised to suit different systems and to achieve good control of parasitism with limited anthelmintic treatment.

Although the discovery of the causes of disease and sub-clinical infections continues to come from the research bench, much remains to be done to ensure that the benefits are applied on the farm. The practising veterinary profession today is concerned because it does not have sufficient opportunity to prevent disease and sub-optimal production. The expanding Veterinary Investigation Services are available to assist veterinary surgeons in the diagnosis and control of intractable problems—their work is widely acclaimed but losses from animal diseases continue at a high level. The 1964 Annual Review of Prices and Determination of Guarantees initiated a Study Group which is a tripartite effort of the National Farmers' Unions, the veterinary profession and the Government, to find the means of ensuring that the benefits of research are taken to the farm. This has resulted in the setting up of local Study Groups in counties, to persuade the farmer that positive health should be the aim rather than treating outbreaks of disease in which sizable losses are unavoidable. Great progress has been made but much remains to be done. There is a growing awareness that the application of veterinary science on the farm must keep pace in its development with the new methods of husbandry. Infections which produced disease at a low level, and was accepted as an industrial risk in extensive systems with low density of stocking, can be explosive and calamitous when they strike large intensive units. It is essential that the practice of modern veterinary science should be increasingly taken into account in the whole complex of housing, management, nutrition, animal behaviour, and other disciplines which are essential in successful modern farming.

One of the computer rooms of the Ministry of Agriculture, Fisheries and Food, Guildford, Surrey

FARM MANAGEMENT ADVISORY WORK PROGRESS AND PROSPECTS

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WRITING in the winter 1953 issue of N.A.A.S. Quarterly Review Mr. Arthur Jones, the N.A.A.S. Chief Farm Management Adviser, said 'Farm management is concerned not only with basic principles of crop and livestock production, but with the business side of farming as well. The overriding considerations in the mind of the adviser . . . should be profitability, practicability and productivity'. Although these propositions would generally be taken for granted today, they accurately reflected the mood of the early 1950s at a time when the N.A.A.S. was in the midst of an active campaign to establish 'farm management' as an integral part of its advisory effort, and extend the work of the relatively few devotees—largely agricultural economists—over the previous twenty years.

The 1950s

The main problem facing the pioneers of the early 1950s was to gain acceptance of the notion of a business approach to farming problems and, in so doing, to achieve much wider recognition not only of farmers' economic

motivations, but also of the vision of whole-farm integrated business unities and the unreality of attempting to distinguish firmly between 'technical' and 'management' aspects.

The economic environment of that time, when the emphasis was on the necessity to increase sheer volume of production with price incentives to match, was not, in itself, conducive to a critical business approach by farmers or by advisers. Yet, at farm level, confronted with new technologies and consequent growing complexity of farming operations, many more farmers were beginning seriously to question the irrational, but prevalent, philosophy that 'sound farming technique will inevitably reap its just and favourable financial reward'. In general, neither farming community nor advisory service were particularly well fitted either by outlook and tradition, or by training, to adopt universally the economic approach.

Exhortation, demonstration and training were the keynotes of the early 1950s and in terms of specialist expertise, the collaboration of, and the leadership provided by, the Farm Management Liaison Officers in the University Agricultural Economics Departments were essential ingredients of the substantial progress made. The names of Blagburn, Wragg and Wallace, to name but three, are an established part of the folklore of farm management advisory work. The F.M.L.O.s carried the burden of training N.A.A.S., and to a lesser extent, farmers, in the elements of economic principles; in the intricacies of book-keeping, farm trading accounts and balance sheets; in the use of the many 'factors-associated-with-profits' ratios; in the arts of simple budgeting; and the application of these at farm level both through personally accompanying N.A.A.S. District Advisers or through group training activities.

The 1950s were characterized in a technical sense by an emphasis on the use of trading accounts for farm management purposes; on improved book-keeping and recording methods; on what we would regard today as highly formalised inter-firm comparison; and on the preparation of Farm Management Handbooks which drew together a body of economic data to provide both background and 'standards' for the advisers in the field.

This decade eventually saw the farm management approach widely accepted amongst advisers and educationists, the progressive section of the farming community, and influential members of the accountancy, banking and consultancy professions. It was generally regarded as a permanent part of the farming scene. This substantial achievement was a major tribute to enlightened leadership at both policy and technical level, and laid a firm groundwork for further development.

The 1960s

If each decade has its noteworthy characteristics, the 1960s must be regarded as that which witnessed a massive upsurge in the volume of farm management advisory case work, a growing sophistication in management advisory methodology, the 'coming out' of the gross margin concept, and a return to focussing in rather more depth on the husbandry considerations underlying the financial facade.

The uptake of the gross margin approach has not been without controversy, and its more sober critics have rightly pointed out some of its shortcomings. Yet it will no doubt prove to have been of far-reaching significance

in the farm management advisory field. Although it had powerful and able advocates, the manner and extent to which it was embraced reflected the timeliness of its introduction. This had several facets. In the first place there was growing a certain disenchantment with the too numerous ratios of comparative analysis and consequently there was a need for a means of analysis that was more readily understood by farmers and advisers alike, that had a more defensible, albeit simple, conceptual basis, that drew attention to the basic elements of enterprise performance and that paid more regard to the individuality of the business. Moreover, the position of gross margins was further reinforced by a changing emphasis from historic analysis to forward planning.

Alongside recording for traditional farm accounts was developing an interest in management accounting, with an emphasis on marginal costing. This again highlighted enterprise performance, essentially though not wholly in a gross margin sense, and made a valuable complement to the enterprise recording schemes developed extensively by N.A.A.S. and other organizations. Livestock enterprises in particular lend themselves to periodic—often monthly—financial and physical checks, designed to give regular guidance regarding management decisions. Dairy and poultry recording proved especially popular and successful. These, and similar schemes, enabled the user to probe beneath the simple financial surface and measure underlying physical relationships so vital to successful outcome. The Farm Business Recording Scheme, which to date in England and Wales has attracted over 10,000 applications—of whom well over 90 per cent will complete both trading accounts and gross margin statements—has given an invaluable fillip to the cause of management recording.

Computer technology did not fail to make its impact. Linear programming became part of the N.A.A.S. farm management advisory tool kit, available to advisers for use when the circumstances of the case warranted. To this end a cadre of advisers was specially trained, and further development work on other computer-based numerical and analytical techniques proceeded. The computerization of the N.A.A.S. Poultry Scheme in 1964 and the Dairy Management Scheme in 1967, eventually enabled a comprehensiveness and flexibility in approach and a service to participants which were impossible, except at great expense, under the earlier hand-calculating arrangements. This is clearly a growth point.

Always part of the farm management scene, but in the latter half of the 1960s coming noticeably to the forefront, was capital investment appraisal. Another product of contemporary circumstances, this led into the fields of investment criteria, cash flow analysis, liquidity, long-term strategic planning, and, inevitably, into taking due note of—although not advising on—taxation considerations. Discounted cash flow analysis was taken up remarkably freely in certain parts of the country, although, in the main, simple cash flow statements accompanied either by more traditional, or by less formal, appraisal methods predominated.

Volume of work

Bare statistics of the volume of farm management case work tell only part of the story, but in 1968 N.A.A.S. gave business management advice, i.e., formal analyses and/or budgets, to over 15,000 separate farm businesses in

England and Wales. Of these, just over 30 per cent were new contacts in the context of formal farm management advice. Approximately 6,000 farmers participated in the various N.A.A.S. enterprise recording schemes. In fact, one of the major problems, as the 1960s draw to a close, is that of coping with the tide of business management advice and maintaining a quality standard in the face not only of increased case numbers but also of the growing complexity of these cases.

My own crude estimate of farm management 'penetration' is that there are probably some 40,000 of today's 140,000 full-time farmers in England and Wales who keep, and use, management records comprehensive enough to permit of formal N.A.A.S.-type whole-business analysis. Alongside this, I would hazard that some 50,000 or so farm businesses in England and Wales during the 1960s had formal enterprise or whole-business analysis and/or budgeting work undertaken on their behalf by the N.A.A.S.

The 1970s

The main challenges which face farm management advisory work, in the early 1970s at least, are already in our sights. In terms of philosophy, one foresees a further broadening of the subject matter base—a continuation of the move from the narrower classical economist approach to the broader business management approach embracing business policy, marketing aspects, operations and systems analysis, human behavioural science, and accountancy, finance and investment.

As far as on-farm advisory methodology is concerned, the requirement is for greater stress on forward looking approaches, with suitable control mechanisms, rather than on retrospective inter-farm comparison. The emphasis should lie on setting appropriate targets for the key facets of the farm business and the subsequent measurement and analysis of difference between 'planned' and 'achieved'.

Aspects of the marketing field—hitherto virtually neglected in an advisory context because of advisory services' traditional 'within-the-farm-gate' outlook—demand closer attention and due recognition of their often crucial role in decision-making. (Marketing problems associated with our own farm management advisory product are not excluded!). Alongside a growing concern with business policy, investment appraisal and taxation considerations will need to run a greater consciousness of human motivations, needs and attitudes.

But, above all, farm management advice in the 1970s will call for more critical and detailed scrutiny of the economic significance of underlying scientific, technological and general husbandry considerations. Inter-disciplinary co-ordination is more vital than ever, both at individual farm level and also in probing in some depth, in more generalized studies, into desirable adjustments in production techniques and farming systems to meet the changing economic and technological circumstances. Organizationally, within advisory services, the concept of an inter-disciplinary 'task force' operating in a whole-business framework assumes considerable significance.

Thus, in a farm management advisory sense, the evolutionary process promises to unfold itself.

AGRICULTURAL MECHANIZATION

PROGRESS AND PROSPECTS

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IT is tempting to compare agricultural mechanization today with that of 75 years ago when there were over a million whole-time workers and over a million working horses; but it is perhaps more useful to consider changes during the past ten years and to attempt to foresee the situation during the years that lie immediately ahead.

In any serious attempt to predict future mechanization developments some effort must first be made to assess the likely labour supply situation, since men and mechanization are, to a certain extent, alternatives. The decline in full-time employed workers in the last ten years has been so steady that the following figures for 1958 and 1968 will suffice:

	Whole-time employees	
Year	*England and Wales*	*U.K.*
1958	432,000	538,000
1968	263,000	324,000

The trend continues. The figures for March, 1969, show a fall of 6 per cent compared with March, 1968 for regular workers. Now that figures for only family workers are given separately, it is interesting to see that the decline in 1968/9 for family workers is also 6 per cent.

Annual expenditure on new machinery, designed to enable fewer men to do at least as much work, is tending to rise: at present it is running at about £100m per annum for Britain. Many farms are already feeling the effects of too little labour for the farming system employed; but there are sufficient examples of streamlined farming systems leading to very efficient production from farming units designed for minimum labour use, that further development in the direction of high mechanization and low labour use is as certain as anything in farming can be. Examples of successful mechanization, often with semi-automation, come from as widely divergent fields as corn growing, glasshouse crop production, and pig and poultry production. Even in difficult fields, such as fruit and vegetable production, there is no sign at present that the pace of progress is tending to level out.

It is difficult to escape the conclusion that unless there are new factors affecting agricultural employment, there will probably be no more than 200,000 whole-time employees in England and Wales by about 1972–3, and no more than 150,000 by about 1977–8. This situation provides the main background to likely mechanization developments. Other background factors of importance are the diminishing numbers and increasing sizes of farms.

One estimate* of the likely effect which amalgamation incentives will have on farm structure, indicates that by 1975 the number of whole-time farms in the United Kingdom may have fallen to 170,000 from the 1965 figure of 220,000. This trend is resulting in sizes of enterprise which are more suited to economic mechanization; but it is not proceeding fast enough to solve problems of economic mechanization on its own, and additional measures, such as shared use of complex machines, will become increasingly necessary as the number of workers falls.

There will, of course, inevitably be social changes which will affect an increasing number of farmers. An increasing proportion of farmers will necessarily spend more time on operating machines rather than on supervising men; and capital expenditure on machines, which may look somewhat uneconomic from a purely financial standpoint, may become desirable because it enables the farmer or his family to do work which would be impossible or unacceptable without mechanization. This then, is the likely background to progress in mechanization in the seventies.

Power and automatic controls

Improvements in the productivity of agriculture depend to a considerable extent on enabling the diminishing labour force to have the benefit of increased power per worker. The ideal is a job, such as milling and mixing or stock feeding, which requires the operator only to press a single button or to set a time-clock, when with the help of a series of automatic control devices, the whole operation will proceed unattended. Such developments are becoming commonplace on modern stock farms.

It is certain that an ever-increasing proportion of farm work will be done in this way; but during the seventies the main aim with *field* work will be to provide the worker with bigger and better machines so that he can do more in a given time. The extent to which it is a reasonable proposition to provide workers with ever-increasing amounts of mechanized power may be seen on a few very large corn-growing farms. On such farms the main cultivations may be carried out by tractors of the 100 h.p. class, but there may also be tractors of the 60 h.p class for such work as distributing fertilizers and 40 h.p. tractors mainly for transport. Often there will be at least twice as many tractors as regular men available to drive them, and this can be justified. It can be argued that the ultimate solution will be driverless power units, and that therefore more development work should be done on these; but, as with some other expensive development projects, it seems unlikely that the probable benefits would justify the extra effort within a reasonable period.

Money spent on automatic control of individual components of man-driven machines, on the other hand, brings immediate rewards; and already we are familiar with many excellent examples, such as Ferguson's automatic draught control, and the more recent automatic control of depth of work of sugar beet and potato harvesters. Table height on combine harvesters, density of bales, and forward speed of harvesters according to crop conditions, are also either available or in the development stage.

**Trends in Agriculture.* B. H. Davey. Agricultural Adjustment Unit, University of Newcastle upon Tyne.

Harvesting a crop of oats for storage and mechanized feeding from a tower silo

Ergonomics

Another important field of development is what is now called 'Ergonomics'. This is concerned with all aspects of improvement of working conditions for the machine operator. Examples of current problems include the need to improve tractor seats and controls so that tractors may be used safely at the higher working speeds of which the machines are capable. Experience has shown that continual exposure to excessive vibration, excessive noise and dust and toxic fumes have been associated with injuries and illness among tractor drivers. It is therefore appropriate that resources should be devoted to solving some of these problems.

Trends in mechanized techniques

Many farms are already at the stage where farming operations which cannot be effectively mechanized have to be superseded by those which can. This leads to simpler farming systems and switching to forms of production suited to the labour and machinery available. Some of the broad effects may now be discussed.

Cultivations

The use of herbicides has become widespread and on the whole effective. There are serious problems with grass weeds and wild oats, but we have reached a stage where it has become necessary to ask what other important functions cultivations have apart from weed control. There has been a tendency in recent years to suggest that many of the factors hitherto considered important, such as aeration and what may be briefly described as 'a good tilth', are really of little consequence. I believe that such hypotheses are already disproved, and that we can safely assume that most soils will have to be cultivated from time to time to get rid of over-compressed conditions,

to let in air and water, and to make the lower layers soft enough for crop roots to penetrate easily. The methods of achieving these broad aims are, however, changing rapidly. Herbicides have already made mouldboard ploughs considerably less important than they were ten years ago; and I expect to see a continued trend towards the use of tined implements, including p.t.o.-operated reciprocating types. This does not mean that we have yet reached a stage where ploughs are unimportant. One of the worries about recent developments is that we need effective tined implements as well as ploughs and herbicides—a combination which can require a great deal of capital where 100 h.p. tractors are involved. The 1968 season indicated that on some farms it will be unwise to consider scrapping the ploughs until better grass weed herbicides are available. Cost factors also have to be considered. Power is cheap, and where it can be effectively applied to cultivations this is often cheaper than the use of herbicides.

Fodder conservation and mechanized cattle feeding

It is a remarkable fact that in spite of the low average level of efficiency of haymaking in Britain, hay represents about 85 per cent of the fodder crops conserved compared with about 14 per cent silage and 1 per cent dried grass. These figures give a good indication of the scope for changes. If hay were generally a first-class feed it would be reasonable to discount the fact that mechanical handling is not as easy as it might be; and if mechanical handling of hay were perfectly solved it would be possible to forgive the variations in quality. In fact, modern methods of silage-making win on reliability, labour economy and certainty of producing an acceptable product and it will be surprising if many more farmers do not take to a modern silage system. However, there is an alternative conservation method, grass drying, which is certainly more efficient from a technical viewpoint and could become increasingly important.

As grass production is intensified, waste due to grazing by livestock becomes increasingly serious. Now that effective and efficient labour-saving conservation systems are available it seems certain that more livestock will be fed from storage, with possibly some 'zero-grazing' direct from the field where conditions are favourable.

Effective labour-saving conservation systems must, of course, be linked up with mechanical feeding, and the whole 'set-up' involves a high capital cost. A few farmers have made the investment and a good proportion of these are well satisfied. Several have extended the system in circumstances where a choice was open to them. A major reason for slow development in this field is that it is possible to achieve some of the benefits by self-feed silage systems which are relatively low in capital cost; and many farmers, whatever their preference on technical grounds, will have to adopt the less expensive system.

Manure handling

It is easy to forget that it was not until the 1950s that, taking Britain as a whole, manure handling meant anything other than loading farmyard manure into carts or trailers by hand fork, and ultimately spreading it from small heaps in the field, again by hand fork. Since then, effective ways of handling manures mechanically, in either solid or liquid form, have become widely applied; and any farmer who has recently started up a new livestock

enterprise without arrangements for avoiding hand work on manure handling has only himself to blame. The main problems in manure disposal arise from farmers creating unnecessary difficulties by concentrating large livestock enterprises in conditions where return of the manure to farmland is not possible. Clearly, such problems can be solved by the development of treatment installations, but such solutions seem unlikely to be cheap. The principle of returning animal manures to farmland appears sound and, in spite of other interesting ways of dealing with manure, it seems likely that this will continue to be one of the major planning needs to bear in mind in the seventies.

Production, harvesting and storage of fruit and vegetables

The pace of progress in horticulture matches, and in some fields outstrips, that in agriculture. The main trend is inevitably to produce on an extensive scale those crops which can be effectively and economically mechanized, and to abandon enterprises which call for excessive amounts of hand labour.

Examples of current trends are the increasing popularity of frozen vegetables such as peas, green beans and broad beans, which can be harvested by a mobile machine and can either be chilled at the farm or in the factory within an hour or two of growing in the field. This can lead to a high quality product, grown and harvested with little hand labour and, in the long run, it is difficult to see how the older methods of picking and marketing can survive on a large scale. Crops such as Brussels sprouts are being similarly treated. Special varieties suited to 'once-over' harvesting are machine harvested and stripped and, though sprouts can be marketed fresh, increasing quantities are likely to be frozen.

Among fruit crops there are already commercial harvesters for black currants, though there is still no certainty as to what cultural methods or machines will be used in ten years' time. Some types of plums for canning can be machine harvested and developments in this direction are likely.

Strawberries are a difficult crop. Development work is in progress, but early commercial success would be surprising. It seems inevitable that it will be luxury crops such as this which will become increasingly scarce and expensive because efforts to mechanize production are slow to succeed, or are unsuccessful.

Operator training a vital need

This brief survey of some aspects of current and likely developments makes it clear that the trend towards replacing men by machines is likely to continue. Getting the best out of machines becomes an increasingly important part of the worker's job, and this requires an understanding of the various controls and adjustments provided. As with less complex skills, much can only be learned by experience, and some kinds of experience can only be acquired over a short season of practical use. Nevertheless, there will obviously be an increasing need to take positive action to provide operators with a basic training, and to reward them for proficiency in a way that will help to avoid losing them to other industries when such skills have been acquired.

New additions and improvements to an old farmhouse

Nigel Harvey summarizes developments and trends in the farmstead

Farm Buildings in the Twentieth Century

FOR the first forty years of this century, economic depression ruled farm and farmstead. Prices, rents and confidence alike were low. The overseas producer, whom Caird had welcomed in 1878 as an ally in the task of feeding the growing population of these crowded islands, had turned successful rival and for a generation the pressure of foreign competition remained the dominant factor in agricultural development.

The consequences of competition

There was no longer any incentive to continue the substantial investment in farm buildings that in the previous hundred and fifty years had created most of the steadings which still serve us. Indeed, as hopes and resources slowly failed, even the maintenance of the existing stock of buildings was neglected. By the 1930s, a study in the Midlands found that half the cow-houses in use needed general or partial reconstruction before they could be

judged fit to produce clean milk, a study in East Anglia that the buildings on nearly half the farms investigated were inadequate or inconvenient, on a quarter in poor repair and on a sixth inadequate, inconvenient *and* in poor repair. The inefficiency of farm buildings had become a recognized weakness in the rural economy.

The pervading themes of this early period were, therefore, neglect and deterioration. But the pressures of the farm on the farmstead continued, indeed increased as the farmer strove to adapt his cropping and stocking systems to the new conditions. Liquid milk offered a line of production with which no overseas farmer could compete, so cowhouses increased in number and improved in design; the pig industry thrived on cheap, imported feeding-stuffs and the traditional pen-and-run system was gradually replaced by more intensive methods of housing, notably the ubiquitous Danish—or, more accurately, Danish-type—house; and poultry buildings followed the same trends as pig buildings for the same reasons. More generally, the farmer turned increasingly to forms of prime mover for farmstead work which was cheaper than the human muscles and limited steam-power on which he had formerly relied.

Machines, concrete and corrugated iron

First came the internal combustion engine, then electricity, and by the later 1930s, static mechanical power ground and mixed fodder, pumped water and milked cows on an appreciable and growing proportion of farms. In most cases, this merely replaced an old by a new form of power and brought little change to the routines involved or to the structures which protected them. But already more radical possibilities were apparent. By 1939 the new milking parlour made possible by the releaser-recorder plant and the new grain drying installation made necessary by the combine-harvester provided prophetic examples of the 'housed mechanical process' of the next age.

Such developments, however, were highly exceptional. The times allowed few such innovations and no general reconstruction. Throughout these years landowners and farmers could do little more than adapt and patch the steadings they had inherited from their Victorian or Hanoverian ancestors. In so doing, they made extensive use of two materials peculiarly suited to structural first-aid and do-it-yourself repairs.

One was cement for the concreting which in these years became a recognized farmcraft, the other corrugated iron sheeting for roofing and walling. Between them these two materials changed the appearance and prolonged the life of the decaying and obsolescent buildings of the depression years. Together with the increasing range of fittings which industry was making available, they also proclaimed the dependence of the twentieth-century farmer on the products of the factory. Significantly, it was in this period that the Dutch barn, the first successful type of prefabricated building, established itself as a normal feature of the farming landscape.

Revival and improvement

In 1939, the pressure of overseas competition was abruptly replaced by desperate domestic need. War restored and peace continued in modified form many of the old necessities and the revived farming system adapted itself to the changing economic times. Expansion, intensification and tech-

nical development meant more production per acre, per beast and per man. They also meant a succession of new demands on old farmsteads.

The farmer wanted to store and process more crops, house more stock and protect more machinery and material from the weather. Moreover, he wanted to do many of these things in new ways with new equipment. But he could not do them effectively in the buildings he had inherited from the past. Predictably, therefore, the revival of farming in the last generation has included a general modernization of the steadings which form so important a part of farm equipment.

Fortunately, once the scarcities and restrictions of the 1940s were past, conditions favoured the modernisers. In general, the state of the industry allowed substantial and continuing investment in farm buildings which the Government encouraged first by tax concessions, later by grants, mainly through the Farm Improvement Scheme. In particular, there has been a steady flow of new knowledge and ideas on design, construction and equipment.

New resources, new developments

Some came from the expanding research services whose conclusions in these years became, for the first time, an accepted factor in the planning of farm buildings. The scope and scale of this change is shown in the technical literature—in 1945 a classic text book was compiled by collating the views of experienced men, but its first major successor, published twenty years later, quoted a mass of research findings as well as empirical information. Others came from accounts of overseas practice which ended the traditional insularity of farm buildings design. And many came from enterprising farmers who experimented with new possibilities and pioneered untried methods.

One corollary of these developments was the appearance of official and private advisory services whose functions included the dissemination of this new knowledge as it became available and assistance in applying it to particular cases. Another was the expansion of the trade which manufactured materials and equipment. The foundation in 1956 of the Farm Buildings Association, the first organization of its kind, bore witness to the increasing interest in this branch of agricultural equipment.

More technically, development owed much to two trends which fulfilled the prophecies of the pre-war years.

The first of these was the acceptance of mechanical power, in particular electricity, as a normal farmstead resource. This completed the mechanization of static chores, notably milking, and made possible such installations as the modern grainstore or the silo-fed cattle yard which are built around mechanical materials handling systems. But electricity also brought less precedented benefits, light and with it a pervading increase in efficiency and cleanliness, localised heating suitable for rearing piglets and chicks and, above all, means of controlling micro-climate in intensive livestock buildings. Few recent innovations have been more important than the fans and thermostats on which depend the man-made environments in piggeries and broiler houses.

The second was the increase in the factory production of building components. Concrete blocks, reinforced concrete and steel members, corrugated

iron and asbestos cement sheeting were joined by aluminium sheeting and plastic roof lights, rainwater goods and insulating materials. The factory has also taken to providing buildings as well as materials, for mass production techniques have been successfully and generally applied to the manufacture of prefabricated buildings. The work of the local builder continues. So does self-help and improvisation on the farm. But a substantial proportion of modern buildings reach the farmstead as sets of factory-made components.

The pattern of innovation

It is pointless to catalogue the new types and combinations of building which have appeared on our farms since the war. You cannot walk a mile in the farming countryside without seeing examples. But it is worth noting the emergence of a general pattern of innovation and development.

A new idea appears; research workers study it, farmers and manufacturers apply it with various modifications: and finally, if proven, it establishes itself in commercial practice with the aid of continuing research and development and the support of the advisory services. So the final system and the building which houses it come as the result of a number of varied efforts by a number of varied individuals and groups. The stories of the herringbone parlour, which originated in New Zealand, of the airtight storage of grain, which originated in France, of self-feeding, which originated in the U.S.A., and of the cubicle system, which originated on a Cheshire farm, all in their different ways illustrate this process.

Achievement and prospects

Yet these varied changes have wrought no comprehensive revolution in the countryside. Over the years, many old buildings have been repaired or adapted to new purposes, many new buildings or ranges of buildings erected, many increasingly drastic schemes of remodelling undertaken. But the number of wholly new farmsteads is small. On most, the familiar juxtaposition of old and new, good and bad, traditional and contemporary buildings continues.

Nevertheless, the rising proportion of new work is obvious and in some areas dramatic. A survey ten years ago found that the statistically average farmstead, that characterless but informative abstraction, contained 2·5 buildings erected since 1945 and 8·4 erected earlier. Today, the figure for new buildings would be considerably higher and the figure for surviving old ones considerably lower. The resultant increase in efficiency is less measurable but is surely at least as great proportionately as the physical improvement.

And the future? That, of course, depends on economic and technical developments, neither foreseeable except by more or less informed guesses at change in the next few years. But one thing is clear. The farming industry, as it strives to meet new problems with new methods and new buildings will rely increasingly on the new knowledge, equipment and materials which come in growing volume from the research-based economy which lies beyond the farm gate.

Today such developments as the chilling of grain, the automation of certain farmstead processes and novel systems of effluent treatment and disposal

illustrate this inevitable trend. By the end of the century, if we accept current prophecies, we may see huge plastic domes in which livestock spend all their lives in precisely controlled environments and materials are handled and processed by pre-programmed mechanisms. But such things should not surprise us. For they will be the result in a new age of the application of the oldest and most basic principle of farm building design, which is the use of the resources of the time to meet the needs of the time.

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The Ministry's Publications

Since the list published in the August, 1969, issue of *Agriculture* (p. 403), the following publications have been issued.

MAJOR PUBLICATIONS

BULLETINS

No. 35. Lime and Liming (Revised) 5*s.* 6*d.* (by post 6*s.*)
No. 81. Peas (Revised) 7*s.* (by post 7*s.* 4*d.*)
No. 156. Cane Fruits (Revised) 6*s.* (by post 6*s.* 4*d.*)

OUT OF SERIES

No. 18. Experimental Husbandry (New) 10*s.* 6*d.* (by post 11*s.* 4*d.*)
Farm as a Business No. 2: Aids to Management—Beef (Revised) 2*s.* 6*d.* (by post 2*s.* 10*d.*)
Infestation Control Report, 1965–67 (New) 14*s.* 6*d.* (by post 15*s.* 4*d.*)

FIXED EQUIPMENT OF THE FARM LEAFLET

No. 14. Sheep Handling Pens and Baths (Revised) 2*s.* 3*d.* (by post 2*s.* 7*d.*)

FREE ISSUES

ADVISORY LEAFLETS

No. 67. Lucerne (Revised)
No. 96. Apple and Pear Suckers (Revised)
No. 359. Leeks (Revised)
No. 443. Potash for Farm Crops (Revised)
No. 524. Bulky Feeds for Dairy Cows (Revised)
(Formerly Feeding Bulky Foods to Dairy Cows)

SHORT TERM LEAFLETS

No. 20. Chemical Weed Control in Flower Crops (Revised)
No. 88. Whole Crop Cereal Silage for Dairy Cows (New)

PERFORMANCE TRIAL REPORT

No. 29. Winter Wheat 'Bouquet' (New)

Priced publications, except where otherwise stated, are obtainable from Government Bookshops (addresses on p. 478) or through any bookseller. Single copies of the free items are obtainable from the Ministry (Publications), Tolcarne Drive, Pinner, Middlesex, HA5 2DT.

ONE HUNDRED AND FIFTY YEARS AGO

AGRICULTURE IN THE TIME OF THE PRINCE REGENT

Henry Button

SEVENTY-FIVE years ago, at the beginning of September, 1894, appeared the first issue of what was then the quarterly publication entitled the *Journal of the Board of Agriculture*. Queen Victoria was in the 58th year of her reign, and the second Board of Agriculture was almost five years old. The Board's address was 4 Whitehall Place, and its Permanent Secretary was Sir Thomas Elliott, who once told Sir Daniel Hall, when the latter was the Director of Rothamsted Experimental Station, that agriculture in England was dead and the Board's business was to bury it decently.[1]

If we step back a further seventy-five years, we find ourselves in the days of the Prince Regent, when another long reign, that of 'Farmer George', was also nearing its end. Let us take a look at agriculture in this country as it was then.

The leading article of *Bell's Weekly Messenger* of 13th February, 1814, was entitled 'Approach of the Allied Armies to Paris' and expressed the hope, premature as it turned out, of 'immediate peace'. Red wheat was quoted on the Corn Exchange, Mark Lane, at 63*s.* to 73*s.* per 'Winchester Measure of Eight Bushels', and the price of beef at Smithfield was given as 5*s.* 8*d.* to 7*s.* 'per stone of 8 lb'.

The reports of the first Board of Agriculture contain a wealth of information about agriculture in the latter part of George the Third's reign. The Board, as Elie Halévy reminds us, 'was not a department of Government charged with the administration of laws. English public opinion had no liking for bureaucracy. It was a sort of corporation, subsidized by the State, whose legal character jurists found it difficult to define'.[2] This first Board of Agriculture was established in 1793, with George the Third as its Patron, Sir John Sinclair as its President and Arthur Young as its Secretary. It was dissolved in 1822.

Halévy says that the Board's reports dealt with 'the condition of agriculture in each of the English counties', but they did, in fact, cover Wales and Scotland as well. Elsewhere too, Halévy appears to equate England with Great Britain. For instance, he describes England as 'the leading agricultural state in the world' at the opening of the nineteenth century, but a little later he says that the large farms of the region which extended from Edinburgh on the north to the border of Northumberland on the south, and especially the farms of East Lothian, 'were the best managed farms in Great Britain—indeed in the entire world'.[3]

Halévy was to some extent echoing a view that had been expressed by William Guthrie more than a century earlier. In 1812, Guthrie published the 22nd edition of his *New Geographical, Historical, and Commercial Grammar; and Present State of the Several Kingdoms of the World*—a sort of cross between *Whitaker's Almanack* and the *Encyclopedia Britannica*. Dealing with agriculture in Great Britain, he wrote: 'In no country is agriculture better understood, or prosecuted with greater zeal for improvement and assiduity'. When he came to deal with 'Commerce and Manufactures', he waxed almost lyrical:

> 'Great Britain is, of all other countries, the most proper for trade; as well from its situation as an island, as from the freedom and excellency of its constitution, and from its natural products and considerable manufactures. For exportation, our country produces many of the most substantial and necessary commodities; as butter, cheese, corn, cattle, wool, iron, lead, tin, copper, leather, copperas, pit-coal, alum, saffron, &c. Our corn sometimes preserves other countries from starving. Our horses are the most serviceable in the world, and highly valued by all nations for their hardiness, beauty and strength. With beef, mutton, pork, poultry, biscuit, we victual not only our own fleets, but many foreign vessels that come and go . . . Prodigious and almost incredible is the value likewise of other goods from hence exported, viz., hops, flax, hemp, hats, shoes, household-stuff, ale, beer, red-herrings, pilchards, salmon, oysters, liquorice, watches, ribands, toys, &c.'[4]

Guthrie might be suspected of nationalist bias, so let us next consider the views of a visitor from another country. With the fall of Napoleon, people from the Continent were once again free to visit England, and among the earliest of such visitors was Hans Caspar Escher (1775–1859), a Swiss industrialist who founded the great Swiss engineering firm of Escher Wyss in Zürich in 1805. He came to England in 1814 to see for himself how English industry had developed while Napoleon ruled Europe, and he recorded his impressions in a series of letters which were published in a Zürich periodical and have recently been translated by W. O. Henderson.[5] Although Escher was primarily interested in industry, he found time to study other things too.

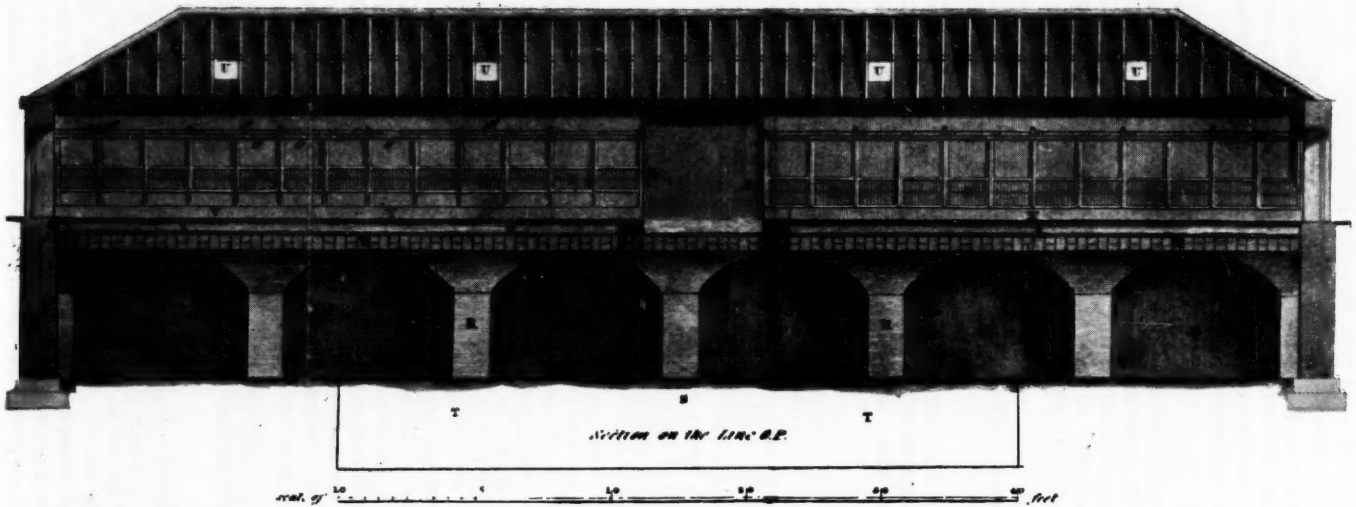
Escher landed at Dover on 1st August, 1814, and arrived in London on 3rd August. His first impressions of the countryside were most favourable:

> 'We left Dover on a fine afternoon. Only a few miles inland we saw very fine crops and other evidence of a high standard of farming . . . The equal progress made by all crops . . . is here a rule without exception. No traveller can fail to notice this. In a field of grain anyone would think that each stalk had been planted separately for they all stand at the same height equidistant from each other. And there are no weeds to be seen.'

Everything in the garden, however, was not perfect. A few days later, while still in London, Escher writes:

> 'Fruit is poor in quality and difficult to buy. As far as vegetables are concerned it is possible to buy very fine broccoli and cauliflowers. I saw many gooseberries of different colours which grew as large as our damsons. By pruning their bushes English gardeners grow giant gooseberries for which prizes are awarded. Such gooseberries are not as healthy as small gooseberries but it is understandable that they should be grown in a country where no good peaches or pears are to be found.'

On 11th August, Escher left London and 'travelled to Manchester very quickly indeed in one of the many thousand coaches that move from one part of England to another'. He left London at 3 p.m. on the 11th and reached



Reference to sections

PP. Cow-house
QQ. Cellars
RR. Longitudinal walls which divide the vaults
TT. Tank
UU. Sky windows
VV. Level of cow-house floor
WW. Section of brick vaulting
XX. Layer of puddle above the brick vaulting
YY. The hecks wound up for admitting the feeding dishes
ZZ. The hecks in their position when the cattle are feeding
&&. The vaults
M. Space for wooden trevis
N. Space for the grating for heck

Sections of a large cow-house

From an engraving prepared for the Harleian Dairy System and published by Ridgeway, London, 1829

'the famous city of Manchester' at 9 p.m. on the following day. On the way, he admired 'the soft green tints of the countryside', but found the English landscape 'too uniform in character'. He was astonished at the absence of fruit trees in England, but he admired the magnificent elms and lime trees in the meadows, 'which please the eye of the landscape painter but do not seem to have been planted for the farmer's benefit'. He continues:

> 'England appears to have better trees, animals and men than any other country. Human beings and animals are well nourished and are not made to work as hard as they might be. It seems ridiculous that a mechanical crane should be used to load a couple of bales of cotton onto a cart. In Switzerland the carter cheerfully hauls the bales onto his waggon with a hook. It seems still more ridiculous that a swineherd should ride behind his pigs on a donkey instead of going on foot.'

I like the word 'cheerfully'.

Escher was soon to see some fruit trees, on the way from Manchester to Liverpool.

> 'The district between Manchester and Liverpool is well cultivated. In the vicinity of Liverpool I saw more fruit trees than I saw around London. Here people eagerly eat quite green apples with white kernels that in Switzerland would only be fed to the pigs.'

On 24th August, Escher left Liverpool for Glasgow, where he arrived two days later. As soon as he had crossed the border into Scotland, 'the charm and beauty of England had vanished. All that we could see were poor dirty villages, wretched roads and bare hills. The further we went the worse the view'. On reaching the little town of Hamilton, however, 'we thought that we had emerged from a desert into paradise . . . The people are of a cheerful disposition and they are not as cold or as solemn as the English'.

While in Glasgow, Escher visited the bathing establishment of William Harley, who also owned

> 'an exceptionally well operated dairy farm. He has a herd of a hundred cows and he is on the point of doubling that number. The cows are clean and are well looked after. They are small beasts which resemble the Toggenburg beasts of Switzerland. The cowsheds have been constructed in a special way. Between each two pillars there is a little passage along which the fodder is brought. A long passage (into which the little passages open) runs right along the cowshed. The mangers are made of stone and are fixed low down on the floor so that the cows can feed when lying down . . . Next to the cowshed there is a steam engine which operates a straw-cutter, a threshing machine and a butter churn. I was amused when we were refused admission to the cowshed without the owner's permission. We were never refused admission to a factory. I was struck by the fact that in Scotland it is the cows and in Switzerland it is the spinning machines which have too many workers to look after them.'

In October, Escher was back in Manchester, having visited Edinburgh and 'the neat little town of Sunderland' on the way. This time he was struck by the greenhouses.

> 'Everybody who is well off in Manchester has a greenhouse in which he grows considerable quantities of grapes, peaches, etc. These fruits are finer and riper than ours but they do not last so long. The fruit trees in gardens and parks flourish in a remarkable way . . . It is remarkable that the smoke from coal fires does no harm at all to apples and does little injury to pears. On the other hand stone fruits are damaged by the polluted atmosphere. The quality of the cherries and plums is not very good. Vinestocks in greenhouses ripen very quickly.'

Later, Escher writes:

> 'The greenhouses . . . are sometimes very large and they are built in an elegant style. They are generally divided into three parts. The middle section is often constructed in the shape of a semi-circular temple with high corinthian pillars and this part of the greenhouse is devoted exclusively to the cultivation of flowers. It has some dainty garden chairs and tables. On each side of this central section there are long wings in which pineapples, peaches and grapes are grown.'

(He might almost have been describing the Great Conservatory at Syon House, except that its construction did not begin until 1820.)[6]

The mention of Mr. Harley's plan to double his herd of a hundred cows serves as a reminder that some of the developments of our own day are not perhaps such striking innovations as one might think. Other examples can be found in the old county surveys of the first Board of Agriculture. Only a few years ago the Royal Show was demonstrating slatted floors; this is what Thomas Rudge had to say on the subject in his survey of Gloucestershire, published in 1807:

> 'Calves are fatted on stages erected for that purpose. The building, and stage, will be proportioned to the number of calves intended to be fatted. Eighteen inches in width, and four feet in length, are allowed to each calf. The stage is elevated about eighteen inches from the ground, and floored with wooden "spars", or strips, two or three inches square, and an inch apart, running parallel with the front.'[7]

Or take machinery testing. A century and a half before the launching of the Agricultural Machinery Testing Scheme at the National Institute of Agricultural Engineering, the Rev. Arthur Young (the son of the Secretary of the Board of Agriculture) was writing in the county survey of Sussex, published in 1813, about the Earl of Egremont, of Petworth, whose many activities in the realm of agriculture included 'setting on foot multiplied experiments to ascertain the comparative merit of different agricultural implements'.[8]

What could be more topical than the housing of livestock? This is what H. E. Strickland had to say on the subject in the survey of the East Riding of Yorkshire, published in 1812. After recommending the under-drainage of land and an extended cultivation of the potato, he continues:

> 'But the largest and last resource for supplying the wants of an increasing population, and which is yet almost untried, is the system of stall-feeding, or constantly keeping in the house or farm-yard all the livestock of the farm, the sheep excepted: this will effect a saving of full three-fifths of the land upon which they feed, which may consequently be applied to the production of corn. The experiment has been carried on for several years on an extensive scale, and in the most efficient and successful manner, by a very excellent man now no more, the late Henry Maister, Esq. of Winestead; a gentleman who, during a life lately terminated (spring 1812) in it's eighty-second year, had no wish but to promote the welfare and happiness of mankind . . . '[9]

As our last example of the modernity of the old county surveys, let us take the problem of the small farm, a common theme in these works. As Henry Holland wrote in the survey of Cheshire (1808), 'The comparative utility of large and small farms is a subject which has excited much attention and discussion in the agricultural world'. He considered that farms of 20 or 30 acres were not enough to furnish full employment to a farmer, and that small farms were an obstacle to improvement.[10]

John Middleton, the author of the survey of Middlesex (1813), took the view that 'there ought to be farms of almost every size', although he went on to say that small farmers 'take care never to be guilty of the folly of reading'. Improvements came from the larger farmers, who 'obtain some degree of education; they read, perhaps, the publications of the Board of Agriculture: they travel and converse, sometimes, with the very professors of Agriculture'. (How delightful is the use of the words 'perhaps' and 'sometimes'.)[11]

Middleton's mention of 'professors of Agriculture' is, perhaps, surprising. The first such professorship in the United Kingdom, the Chair of Agriculture and Rural Economy at Edinburgh, had been established as recently as 1790.

According to the survey of Staffordshire by William Pitt (not to be confused with the statesman of the same name), which appeared in 1808, 'within the last 20 or 30 years the consolidation of small farms has been not uncommon: and indeed a farm of 20 or 30 acres is too small for the sole employment of a farmer, and only adapted to people retired from business and preferring to live in the country; or to country tradesmen'. They evidently had hobby farmers in those days too.[12]

As we thus look back over the century and a half that separates us from the days of the Prince Regent, we should perhaps ask ourselves whether the writings of the Board (or Ministry) of Agriculture of today will be read with equal interest in the year 2119 A.D.

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(The County Reports to the old Board of Agriculture are now being reprinted by David and Charles, Newton Abbot.)

This article has been contributed by **Henry Button,** the Ministry's Principal Finance Officer and the Honorary Review Editor of *Business Archives.*

THE AUTHOR

Professor John Ashton of the Department of Agricultural Economics, University of Newcastle upon Tyne, considers the impact of Government policy, past, present and future, on

British Farming

POLICY for agriculture has always been an integral part of the nation's general economic and social policies. Hence, when industry was looking for enlarged markets and when the population's needs had begun to outstrip the potential production of home agriculture in the nineteenth century, the Corn Laws were repealed. To this extent, it was general economic and social policy which had a major impact on British farming. These forces have continued to influence the agricultural industry, although the circumstances have differed, over the years. In fact, the legislative framework within which agriculture performs has increasingly recognized that the wealth and prosperity of the nation rested on a wide variety of economic activities in addition to agriculture.

Government policies specific to British agriculture were essentially technical and supervisory in the early days of the special department of government established to deal with agricultural matters. Nor is this unusual: in many countries of the world today, the local Ministry of Agriculture is predominantly concerned with production, both its organization and effectiveness. Meanwhile, other departments, of Commerce, Trade and so on, are concerned with the whole range of activities which affect the prices received by farmers for their products and, therefore, the amount and kind of agricultural production that takes place.

There are thus two major areas in which government policy has affected and affects farming. On the one side there is policy determining the economic framework and this is not necessarily specific to agriculture. Thus, apart from price policy, there are, for instance, taxation and monetary policies, which not only have a significant impact on how farmers react to current conditions, but also help to determine the conduct and performance of the rest of the economy. On the other side, there are the technical and specialist provisions of policy where the impact is primarily upon domestic agriculture. Thus the early functions of government in this field were directly related to

the health and quality of livestock, especially through control of serious disease and the supervision of breeding standards. Also, at an early stage, the Government initiated the Agricultural Census as a basis for forming judgment on the state of agriculture in the country. In this context, it is of interest that responsibility for publishing the results of the Census lay with the Board of Trade, and collection of the Census was the duty of the Board of Inland Revenue. The publishing function was transferred in 1883 to the Veterinary Department which was an office of the Privy Council. But in 1889, the Board of Agriculture was set up to take charge of the whole range of government functions concerning agriculture. It was not until 1909, however, that a Parliamentary Secretary was appointed, and as recently as 1919—just half a century ago—that the Board was transformed into a Ministry with appropriate Parliamentary status. It was at that stage that responsibility for collection of the Census material was transferred from the Board of Inland Revenue to the Ministry itself.

To a large extent the early growth of the agricultural department was adventitious and reflected the widening of technical and scientific processes in farming. Later, the department also assumed an educational role both in promoting advisory work among farmers and in the training of professional and scientific workers in agriculture. By and large, its functions were regulatory and supervisory, including dealing with issues related to land tenure. All of these activities were bound to have only a gradual impact on farming as an industry in that they progressively affected the knowledge of agricultural processes and attempted to bring about changes in the right direction. Moreover, as a department, the Ministry of Agriculture remained relatively small. Major issues, such as trading policies, remained in other organs of government with the Ministry only participating as one of many interested bodies.

Following the shortlived boom in agriculture at the end of the first World War, the industry virtually went on to an 'under care and maintenance' basis and the Ministry's role corresponded. That is not to say that general policies did not affect farming during this period. Indeed, they did. While much of the rest of the economy boomed in the 1920s, agriculture, like mining, textiles and other industries hit by competition, languished. And the reason that it languished was that our trading policy was such that imports could invariably undersell domestic production. As a result, low cost, low output systems of extensive farming were adopted.

However, there comes a point where the social impact of commercial policies is too grave to permit their continuation unfettered. Such a point was reached in the early 1930s when continued agricultural depression, coupled with the impact of the general depression following the great crash of 1929, had intensified the adversity of agricultural conditions. At this stage, the fortunes of the industry were to reach their lowest ebb, at least in this century.

The Wheat Act of 1932 and the Marketing Acts of 1931 and 1933 initiated a change in policies which were to have a profound effect on farming. In the context of history, these changes, including the introduction of tariffs on all food except from sources within the British Empire, were as important for farming, although less dramatic, than the repeal of the Corn Laws nearly ninety years earlier, for they marked the end of the free trade era. They also marked the beginning of a protectionist policy, not only for agriculture,

which has seen the re-emergence of agriculture as an important sector of the economy. Farming has been transformed from a position where it stagnated at a low level of activity to one, today, where it has become highly advanced technologically, highly capitalized, prosperous and buoyant, and a thriving section of the economy.

In this process, official policies have been characterized by a gradualism in approach—apart from the years of the Second World War and immediately after when production was stimulated to the limit of physical potential by price incentives and other means. But, it was essentially during this period that the transformation of farming was started with the uptake of new technology, the substitution of capital—intensive techniques for manual processes and the adoption of modern practices generally, in the production of both crops and livestock. These changes not only had a massive impact on the output of agriculture, but also on the composition of this output.

More recently, in the last fifteen years, with plentiful supplies of food available on world markets, farmers have had to strive to become more competitive. As a result, there has been increased attention in policy formulation to market requirements, although some commentators would say not enough. Also, attention has had to be paid to cost-reducing processes as the key part of productivity improvement. Generally, most cost reduction has been associated with increases in the scale of output, capital investment, and large increases in labour productivity. It is in respect of the last that agriculture has stood out within the economy. In achieving this, it has become much more dependent than formerly on capital, and on farming requisites from industrial sources.

Throughout this transformation, agricultural policies have become more sophisticated. But the business of farming, as such, had not come within the ambit of official policies until relatively recently. There was, in the 1930s, much useful background study on the marketing side leading to the classic publications called the 'Orange Books', in which the marketing of the principal agricultural products were described in most cases for the first time. The policies of the 1930s, augmented by war-time and post-war measures, including the famous 1947 Agriculture Act, led to an increasing degree of government involvement in the intimate affairs of farming as a business and its profitability.

Under the policy of the time, the Government now had to attend to the need to ensure that the industry was not only stable and efficient but also producing what was wanted in the national interest and, to quote the 1947 Act '. . . producing it at minimum prices consistently with proper remuneration and living conditions for farmers and workers in agriculture and an adequate return on capital invested in the industry'. These are major responsibilities and to meet them the Annual Review of the economic conditions and prospects for the industry is conducted by the agricultural departments.

Consistent with the requirement under the 1947 Act for stability, and augmented by the 1957 Act giving long-term assurances to the industry, scope for immediate impact of Annual Review decisions has been limited. In the longer-term sense, the impact can be considerable and the system tends to work satisfactorily in an output-expanding period. But when market requirements are met, the impact becomes more blurred: that is, it is much more difficult to stabilize or even decrease production of those products in over-supply, especially when technical efficiency is increasing and contri-

buting to increased output, than it is to deal with those products where there is still scope for expansion. Hence, the diversity of measures which have emerged for a number of products to place some form of quantitative restriction on the output coming within the scope of the guarantees.

Moreover, there are other changes in farming, which are continually occurring, because farmers have to compete with other industries for resources and are affected by general economic conditions in the economy at large. As a result of all the forces at work, farming has become more specialized in production, larger in scale and concentrated in fewer and fewer hands. In other words, the structure of the industry and pattern of production have changed markedly and it is with this aspect that recent developments in policy have been concerned. They have included provisions for various structural changes including encouragement for amalgamations, for retirement annuities, and for special arrangements for the comprehensive development of certain areas, notably mid-Wales, the Northern Pennines and the Highlands and Islands of Scotland, where agricultural resources are comparatively limited and alternative employment opportunities are few. Increasingly, this concern over the future shape and pattern of the farming industry could find expression in policies influencing the pattern of land use and the structure of agriculture—perhaps to as great an extent as the enclosure movement of the late eighteenth and early nineteenth centuries.

For the future then, and leaving aside the possibility of membership of the European Economic Community, the impact of government policy is likely to be critical. It will not be confined just to intervention over prices and markets; nor to settling the question of how much, if any, free trade and how much protection; nor to operating a service to encourage plant and animal health and improvement; nor just a machine for measuring acres and livestock numbers. Rather, policies may well be developed which identify fully the contribution of agriculture to the economy, the cost and productivity of resource-use in agriculture in relation to alternative uses, with appropriate returns to farmers. They will also provide the framework within which the best results both for the nation as a whole and for the agricultural industry can be achieved.

It may be that such policies will require a degree of precision in evaluation that is not yet attainable. Whether or not this is the case, policy decisions still have to be taken however imperfect the data. This might therefore suggest the need for an indirect approach to policies to ensure that the general environment enables economic forces to operate, even though such forces are themselves inherently difficult to measure.

Moreover, there will always be the need to reconcile a variety of often conflicting objectives. In agriculture, such conflicts arise because social changes in farming lag in relation to economic and technological advance within the industry. But, to an increasing extent, government policy will attempt to smooth the transition in order to achieve those adjustments which are most desirable. Ultimately, in the longer term, the disparities between rural and urban incomes should be diminished, with resources flowing freely from one to the other according to their best use. At that stage the impact of government policy on farming would, it is to be hoped, be such as to provide the best opportunities with the minimum of intervention. It is almost axiomatic that farming as we know it today will have changed considerably.

Part of hill land on the Pwllpeiran Experimental Husbandry Farm

75 YEARS OF WELSH AGRICULTURE PROGRESS AND THE FUTURE

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PROGRESS is relatively easy to assess, but forecasting the future is a most hazardous and unrewarding process. Wales has been endowed with more than its fair share of 'wise men' or, more accurately, soothsayers, and it is particularly important that the writer should take every precaution not to perpetuate this tradition.

During the period under review Welsh farming has seen more changes than at any time in its history and the rate of change has been particularly significant from the 'mid-thirties' onwards. Progress is a function of the rate and magnitude of change and when we recall that in the mid-nineties Welsh farming was a self-sufficient economy almost wholly concerned with cattle and sheep stock rearing, the situation today indicates considerable progress. Climatic and topographical factors favoured cattle and sheep rearing systems, and remoteness imposed a built-in resistance to change. Progress, therefore, has to be measured against this background. During the first half of the period under review progress was slow, but thereafter gathered considerable momentum. Naturally, developments in Welsh farming followed the fortunes good or ill of the Nation's economy, but on the relatively small family farms ability to 'live hard' in the face of adversity, enabled Welsh farmers to withstand and overcome the vicissitudes of the late 'twenties' and early 'thirties'. By the same token it is possible that in the rapidly expanding

economy following World War II this factor may have inhibited Welsh farmers from expanding quite as rapidly as their English counterparts.

Three factors gave impetus to progress in Welsh farming in the 'mid-thirties'. The first and second of these were the widespread adoption of the internal combustion engine as a source of power for cultivations and rapid means of transportation, coinciding with the growth in communication media, particularly radio and the farming press. These factors enabled the remote farming communities to become an integral part of the broader world. The third factor which accelerated progress was the setting-up of the Milk Marketing Board in 1934. The Board's policy brought about a rapid expansion in milk production in Wales whilst at the same time enhancing the profitability and the cash flow of dairy enterprises. At about this time the Tuberculosis Attested Herd Scheme also gave a wonderful fillip to milk production.

Following World War II food shortages, government policies, particularly those concerned with hill and marginal land and the improvement of fixed equipment, the setting-up of advisory services, the evolution of new techniques and the rapid expansion in mechanization, radically improved the rate of progress. New philosophies were propounded; new vistas opened up in the Welsh farming scene, and increasing inputs and intensification of output leading to higher profits, transformed once and for all the way of life traditionally associated with Welsh farming.

Progress in farming in this day and age is associated with the term 'productivity' especially in its relation to utilization of capital and labour. Changes in scale and intensity of operation, associated with the introduction of new techniques over the last seventy-five years, have had a marked effect on Welsh farming.

Change in structure

The table below gives a broad picture of structural changes over the period in question:

Table

Size group acres crops and grass	*1913 Approx. No. of farms*	*1928 Approx. No. of farms*
0— 49	46,000	25,000
50— 99	11,000	9,500
100—149	4,800	5,600
150+	3,900	6,700

The trend in Wales towards larger farms has been similar to that in England and Wales, but the rate of change has been slower. This is not surprising in a region with a high proportion of small farmers dedicated to livestock production and deeply attached to their land and hearths.

Labour and machinery

Wales is predominantly a family farming area. Many farms are run by the farmer and his wife alone, a high proportion of workers returned in the statistics are farmers' sons and daughters, and other family workers. From 1921 to 1967 the total number of regular and casual workers has been halved in Wales, whereas in England and Wales as a whole the total number of

workers had dropped to one-third of that in 1921. The rate of decline in Wales, therefore, has been slower. Two broad factors account for this: these are that our mainly small farms on difficult terrain make it hard to introduce a high degree of mechanization, and that livestock systems practised in Wales, apart from dairying and intensive pigs and poultry, have on average a higher labour content than arable and mixed farming systems.

Reduction in labour can only be achieved where it is replaced by machines and well-planned buildings. Tractor power over the period under review has completely ousted the horse, the change commencing in the 'mid-thirties' and accelerating rapidly from 1940 onwards. The wide adoption of hay and silage-making machinery has revolutionized conservation processes, particularly the pick-up baler and the silage cutter loaders. Mechanization of FYM and fertilizer spreading has eliminated hard graft. The mechanization of lime and fertilizer distribution has been the main factor in achieving the substantial increase in production from hill and marginal land areas.

Improved labour utilization has been achieved on a large-scale in our milk production systems through the introduction of well-planned buildings, self-feeding systems and, more recently, well-designed parlours with self-cleaning, pipeline milking systems. Bulk tanks are also being introduced at a very rapid rate in those areas where this is possible. In the case of beef and store cattle, wintering systems and improvements in labour efficiency have not been widespread or as effective as in the case of milk production.

Intensification and specialization

Looking back over seventy-five years, tillage has dropped from 500,000 to approximately 300,000 acres, yet cattle and sheep numbers have increased by about 63 per cent and 75 per cent respectively. Surprisingly, pigs have remained relatively static and poultry have increased by about 80 per cent though the figures in respect of both categories do not reflect the increase in turnover due to the introduction of intensive systems. The substantial increase in cattle and sheep has been made possible by: firstly, the growth in use of the purchased feed; secondly, by improvements in production, conservation and utilization of grass via greater use of fertilizers and, thirdly, by the reclamation of upland and hill grazings, especially since World War II.

Moreover, government policy from the 'mid-thirties' onwards encouraged expansion. The eradication of tuberculosis, and the availability of modern veterinary techniques have improved the health standard and performance of our livestock. Special schemes to help the hills and uplands have injected much needed capital into our hill areas, bringing about improvements in output. The advent of the Milk Marketing Board, reinforced by war-time policy in relation to milk production, brought about a rapid expansion in dairying with the result that today over a third of total output from Welsh farming comes from milk alone. This increase in livestock numbers and expansion in production, has helped net incomes to maintain an upward trend despite the pressure of rising costs, and progress can only be maintained by still greater intensification and specialization. Up to World War II, Welsh farms had on average about five enterprises: today the number has eased down to around three. New farm enterprises, where special factors such as climate or scale of farming allow, have been introduced to Welsh farming systems during the last thirty years. Notable amongst these has been the

introduction to, and expansion of the early potato crop in Pembrokeshire, the Gower and more recently in South West Caernarvonshire. Turkey production has also grown apace in Pembroke, as have large broiler and egg-laying intensives in South Wales in close proximity to the large urban conurbations. In some of the upland areas, particularly in mid-Wales, seed corn and seed potato production run in harness with traditional livestock systems. The seed potatoes are marketed mainly in Pembroke and the Gower —a nice example of integration between farming systems.

Production and marketing

Despite the evolution of these more exotic enterprises, Wales still remains firmly wedded to the grass/livestock complex and it is pleasant to record progress since World War II in the production and marketing of livestock, notably store cattle. The pioneering work of the Brecon and Radnor Suckled Calf Association has been emulated elsewhere with success. The concept of contract marketing of store cattle according to condition and weight is in the early developmental stage, so is group marketing of fat lambs and draft ewes. In respect of weaner marketing, the Welsh Federation has led the way and is now exporting to France as well as across the English border.

What of the future?

To attempt to look into the future of Welsh farming at this point in time is foolhardy, because it is impossible to anticipate changes in the economic climate, new developments in Government policy, especially the impact which joining the E.E.C. would have on Welsh farming if and when this comes about. Someone said that 'the future cannot be forecast with eyes in the back of one's head' and in trying to anticipate changes over the next 10–15 years it is dangerous to project the future of Welsh agriculture on past performance. One may, however, be permitted to put forward a hunch or two, based on a life-time's experience of Welsh farmers and farming.

First and foremost, Welsh farming economy is likely to be based more firmly on grass production as our cattle and sheep orientated farmers improve their mastery of the techniques. The present tillage/grass ratio of 300,000/3,900,000 is likely to decline still further. The present trends in farm structure will continue, but I suspect at a reduced rate despite the attraction of the Amalgamation Scheme. A decline in the number of workers is on the cards but the rate will depend on availability of alternative work in the rural areas. This will subject some cattle and sheep systems to considerable further strain because of the high cost of mechanizing indoor feeding and cleaning systems. Further specialization, intensification and streamlining of production is bound to come about to minimize the effect of heavy capitalization and preserve real incomes at acceptable levels. This will be achieved by the wide adoption of new techniques. Our young farmers are keener than their forebears and will not lose any opportunity to study and evaluate new developments resulting in a greater degree of innovation in Welsh farming.

Dairying in the next decade is likely to remain the biggest single enterprise in Wales, though one detects in some areas a move towards cattle and sheep fattening. Economic and social forces will bring about a fall in the number of dairy farms, accompanied by a slight expansion in cow numbers and increase in output of milk. Labour saving techniques in the yards and parlours

will certainly lighten the load on the family and the workers. The demand for specialization might well encourage a move towards summer milk production off grass, enabling Welsh dairy farmers to cash in on their main asset and at the same time providing a welcome break from the drudgery involved in milking seven days a week, fifty-two weeks a year.

Cattle and sheep fattening on the lowlands has, relative to milk, recently become more profitable and this trend could well continue for some years. New techniques, using medium levels of nitrogen, and paddock facilities to rest land over winter, may induce a higher degree of intensification and may be able to compete successfully in farm-income terms with milk production.

In the uplands, cattle and sheep rearing systems will continue to intensify as more of the uplands are reclaimed and fully utilized. Livestock intensities from one L.S.U. to 1·6–1·8 acres are already achieved in some areas, and there is a definite move to fatten lambs rather than to rely on the vagaries of the draft ewe market.

Similar trends are to be detected in the hill farms. Improvement in income is likely to come about by improvement in the scope, scale and prolificacy of the hill ewe rather than an increase in flock size. Moreover, the introduction of new strains of grass and forage crops may also enable hill farmers to fatten a proportion of their store lambs, thus improving and stabilizing their incomes. Integration of hill and lowland farms on a wider scale is also on the cards—a revival of the 'Hafod and Hendre' system.

With regard to specialist enterprises, whether intensive livestock or cash crops, one cannot envisage rapid expansion, but in the longer term it is possible that the production of potatoes for canning may develop side by side with early potato production; increasing the scope for seed potato production in some areas; broccoli and sprouts may be introduced into the rotation as well, probably in co-operation with growers from East Anglia.

One cannot foresee any revolutionary changes in Welsh farming over the next decade or so. It is likely to be a period for the laying of sound foundations rather than the putting up of flashy edifices. Moreover, the younger generation is fully aware of the importance of market signals and appreciates that new techniques alone—however well conceived—do not ensure adequate income from the farm. Undoubtedly, more attention will be given to markets and marketing methods and to evolving a high degree of integration between production and marketing.

It was R. S. Thomas, the poet, who described Welsh farmers thus:

> '. . . *Yet often from such*
> *Those men came, who, through windows*
> *In the tick mist peering down*
> *To the low country, saw learning*
> *Ready to reap. Their long gnawing*
> *At life's crust gave them teeth*
> *And a strong jaw and perseverance*
> *For the mastication of the fact.*'

No doubt Welsh farmers will masticate more facts over the next decade or so.

LAND COMMISSIONERS OF ENGLAND
1894

L. M. PARSONS, B.Sc. (Agric.), F.L.A.S.

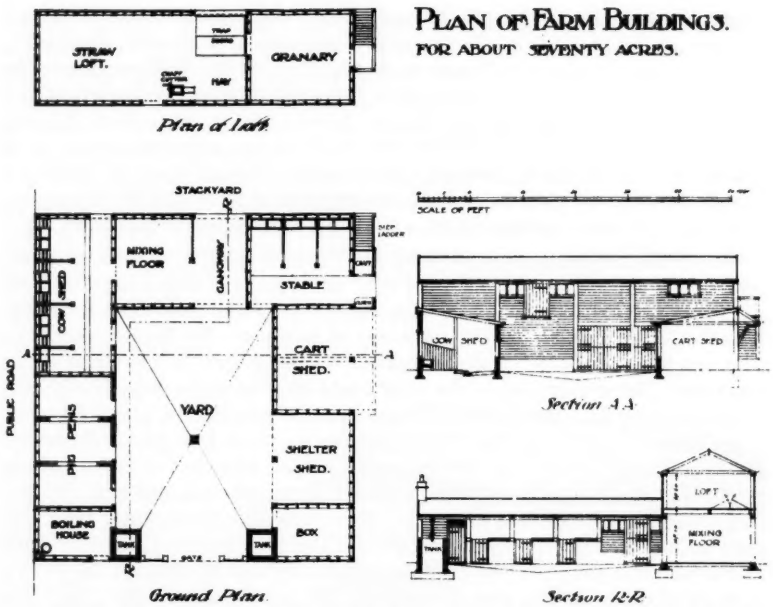
Land Commissioner in the Agricultural Land Service

'To all to whom these Presents shall come
The Land Commissioners of England send Greeting.'

THIS stirring salutation began most of the earliest of some forty thousand documents preserved in the archives of the Ministry or at the Public Record Office. These deal with Determinations of Compulsory or Voluntary Enfranchisements of Copyhold, Manorial Incident Extinguishments, Deeds of Declaration or Orders of Limitation, Inclosure Proceedings, Regulation of Commons, Exchanges of Glebe Lands and many other immemorial incidents affecting land. These were and remain the responsibility of the Land Commissioners of the Board of Agriculture and of its successors (indeed the present Agricultural Land Service dealt with one or two as recently as 1964). Regrettably the more modern documents are in quite a different form and by no means on such beautiful or such expensive blue paper; also alas, not in copperplate clerk hand, and certainly not signed with the flourish of a quill pen.

Fortunately a selection of much less official sounding files have escaped destruction, and these shed some light on the frailties and foibles of the Land Commissioners in the closing years of the last century. The air of illimitable leisure, timelessness and perfection in all things conveyed by these old files, the strict professional tradition and etiquette revealed by the reports and minutes of the Commissioners, together paint a picture of a solid, settled way of life and work at 3 St. James's Square, London, in 1894.

The Land Commissioners of the Nineties could proudly claim a most ancient and honourable history. The Act establishing the Board of Agriculture in 1889 had transferred to them the powers and duties of their predecessors under the Tithe Rentcharge; the Copyhold; the Inclosures, Commons and Allotments; the Drainage and Improvement Acts and many others, for instance, the Universities and College Estates Act of 1858. The Commissioners themselves were formally established by Section 48 of the Settled Lands Act of 1882, and had taken over all the responsibilities of the Tithe, Copyhold and Inclosure Commissioners hitherto separately responsible for Tithe (1831), Copyhold (1841) and Inclosures (1845). Sir James Caird, then Chief Land Commissioner, was made a Privy Councillor, appointed to the new Board and apparently given complete authority to act



A design for a mixed farm of 70 acres by H. Munro Cautley, A.R.I.B.A., Architect, 1904, who said 'I am mainly attached to smallholdings in theory, though confess a doubt of their practicability at the present time'

for the President, Henry Chaplin, 'in an emergency'. Unfortunately, history does not relate whether he actually used these powers, but he was now firmly in control of the workings of the new Board. The Land Commissioners were virtually the only professional or scientific staff available for work in the field and for carrying out the Board's responsibilities.

The recommendations of the Richmond Commission, designed to arrest the impoverishment of agriculture, had gradually been put into effect since the depression of 1875–1884. By 1894 the Board felt able to congratulate itself on a slow but sure improvement in agriculture generally.

This apparent air of immutability and the inevitable course of nature in the countryside can be detected in many writings of rural life during the last decade of the dying century. Arthur Street wrote with nostalgia of the regular, inexorable sweep of rotations on the chalklands of South Wiltshire—'It all seemed such a settled, prosperous thing—the spacious days—'. Richard Jefferies could find trout at Tolworth Mill and enjoy rural solitude at Balham, or pick armfuls of wild flowers in a peaceful countryside near Beckenham. W. H. Hudson could write of the almost biblical life of Caleb Bawcombe shepherding his flocks on Martin Down. The Forsytes lived the unalterable life of the genteel, powerful middle class in a city where all seemed right with the world. Nevertheless, there was another side—and a much darker one—that was full of foreboding for agriculture and the countryside.

The Wessex dialect poets William Barnes and Edward Slow, when writing of local events and worthies, more than once hinted at rural disquiet, the

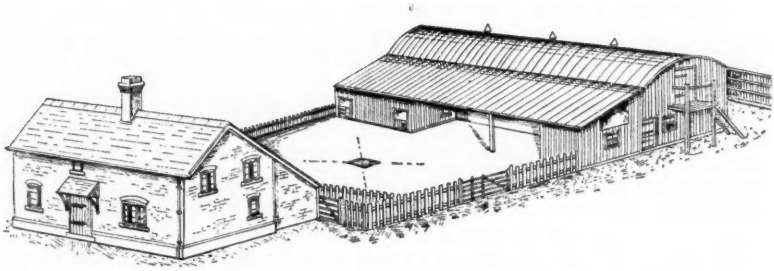
need for land reform, the iniquities of Tithes, Rates and Taxes, of village poverty, the drift from the land and the anxieties and miseries of country folk. Many passages from Hardy or Trollope or Alfred Williams movingly illustrate the fears and uncertainties of the ordinary country dweller of the time. Roland Prothero, later to become Lord Ernle, went further. To him the agricultural depression of 1891–1895 had 'all the ugly characteristics of a modern financial crisis', owners and occupiers of land 'stood at the brink of ruin', thousands of acres of land had reverted to tumbledown pasture or, as one Land Commissioner wrote in a report, 'Land lying to lark-leaze'.

Many Commissioners' reports of the time reveal the malaise of rural workers—for instance, 'Mr. M. told me "The men have their heads 'up' and would stir if they saw a chance but they cannot do much in these flat, 'hanging' times". Or 'During my visit a strike was in progress—the farmer seemed to have taken a somewhat rigid and uncompromising view of the rights of an employer'. Some members of the staff could be even more outspoken, thus, 'It is a notable fact that farmers always had the privilege of grumbling, but I am entirely against Tithe. If you gentlemen would buy up the Tithe we could get on—some of you gentlemen in London who do not pay anything might contribute'. Harley Grellier, a Land Commissioner concerned with the inspection and redemption of small Tithes, was clearly extremely busy. He said he had been personally responsible for the redemption of one-thirteenth of the whole of the Tithes of England and Wales, and he thought the 'heavy expense of doing so was scandalous'.

Gay and naughty the Nineties may have been, but the Land Commissioners and their staff could have taken little part in the revelry, at least in 1894. There were countless inspections of land to be made, reports to be written, evidence to be prepared for various Royal Commissions, to the Chamberlain Committee on Smallholdings, settlement of partitions and exchanges of land under the Inclosure Acts, reports and visits under the Copyhold Act of 1894, help to the newly established Local Government organizations and a host of other duties. The staff was very small and behind the quiet exterior of 3 St. James's Square there must have been intense activity. From the numerous journeys made around the country one can imagine the frantic thumbings of Mr. Bradshaw's Guide, the packing of Gladstone bags, kitting out with suitable country attire for hard travel, the collection of equipment—'All maps must be securely rolled and interleaved with paper on a stout wooden rod and covered with waterproofs whenever taken from the Office'—'All field entries to be made in Black ink or Metallic pencil'—the telegraphing for 'A conveyance to meet the Commissioner at the Railway Station.' Upon return, the writing of Reports and Minutes—'Sir, I have the honour to present to you my Report upon the enquiries I was directed to make with respect to . . . '. The letters of thanks—'I only desire to add that my short stay was rendered personally agreeable and my duties greatly lightened by the kindness and hospitality which I received from many of those with whom I had the pleasure of being brought in contact'.

Much of the outside work concerned the creation of smallholdings in conjunction with the new County Authorities. Then, as now, the Commissioner's duty was to 'Associate himself as representing the Board with all such work and especially to take any steps which appear to be necessary to safeguard the interests of the National Exchequer which has been responsible for financial assistance'.

The Board felt able to say 'If the truth were known the Commissioner is considered as much a friend as a watchdog'. Or, 'The man on the spot is more likely to be cognizant of practical considerations than anyone in a London office'—a most refreshing statement. Nevertheless, there were difficulties. 'A considerable amount of criticism was directed against efforts to secure that cottages be provided with a bath' (*sic*). 'The provision of baths was in fact regarded with levity in some parts of the country. It can however be claimed without exaggeration that the setting of a high standard has borne fruit. So far as baths are concerned, experience has shewn that the bath is not used for storing coal or potatoes as was often stated would be the case'.



Model set of buildings for a 50-acre farm in the late nineteenth century. This type of building was designed to meet the exigencies of the times in the matter of expense and would meet the Board of Agriculture's requirements

The Commissioners' duties in reporting to the Royal Commissions and Select Committees meant endless interviewing of farmers and landowners and inspecting land and buildings. Their task could not have been made any easier by the depression, nor by the fact that 1894 was one of the wettest years of the century following upon a severe drought in 1893 and two cold summers in 1891 and 1892. The summer of 1894 was 'a disheartening time for farmers. The most sanguine hopes were entertained for a harvest of abnormal excellence but conditions proved more and more inclement with excessive rain and flooding'. Perhaps this influenced one Commisioner who, reporting on some squatters' houses on a Common, wrote 'Some are built of mud and straw and are of an extremely low type—a type which the Land Commissioners would not pass for a moment. But the dwellers I met are independent and put up with the inconvenience. They are industrious and —a more cheerful note creeps in—they like their liquor and get their fair share of liquor but still they are good fellows'.

Yet another writing about the thankless task of finding labour for small-holding work said 'There are difficulties of bringing men over from towns to work. Even those who left in the depression might not be suitable, as some when they go to large towns with families become depraved almost and unsuitable'.

Whenever farm buildings were under discussion there were just as many differing opinions as there are today and just as much criticism of officialdom. One gentleman borrowed £340 under the Improvement Acts to erect some new buildings. He was most dissatisfied with the whole affair. 'The Land Commissioners' charges are exorbitant:

	£	*s*	*d*
Fees	16	19	1
Tracings and plans and cost of copying		11	6
Office charges	1	13	11
Land Commission Inspectors	7	1	6
Stamp		11	6
Registration	1	1	0
	27	18	6

I consider these Terms far too high. Furthermore they insist upon having buildings of a particular size and shape.' Owners complained that whilst corrugated iron was accepted for building, the life allowed of 'only twenty years' was a harsh imposition. Again 'sarking of $\frac{3}{4}$ inch thick is a thoroughly antiquated provision'. So were 'granary floor timber beams of 14 inch square section when steel beams are now available'. These all have a familiar ring although another letter recorded 'I find the Inspectors are not too particular—I don't think they ask for anything extravagant or unnecessary'.

Of course not all farmers or owners were poverty-stricken, and many smallholders were able to weather the storm. Henry Rew, an Assistant Commissioner, quoted a three-acre holding in Wiltshire as an example of thrift and industry. 'There is a four roomed cottage and a pig-sty. The land is mostly cropped with vegetables which the wife, an energetic business-like woman, takes once a week twelve miles distance to town. A donkey and cart is kept for this purpose.' Many landlords were still providing more up-to-date equipment, for instance, Lord Methuen was able to provide all his farms with new Dutch barns in the early Nineties.

A Commissioner was able to write in 1894 'Some wonderful accommodation on a 250 acre farm was provided for under £400 . . . a most compact set of buildings comprising two yards, cowhouse for twelve, stabling for two horses, a good deep cartshed 24 feet deep, a mixing house, a bull stall and an open shed for each yard. The cost of the whole, including spouting, roofing and a close fence 5ft 0in. high was less than £400. It is built of timber with brick foundations and is really worth going to see'.

The Commissioners were never too busy to spare interest in other aspects of farming. One of them during a trip to Hampshire was fascinated by the wedge shaped stacks of watermeadow grass silage which he found 'very common' and 'rendering much satisfaction to the farmers by saving the expense of "silos" '. Another reported on the practice of letting milking cows and remarked of a farmer in Dorset 'This pluralist dairyman manages 300 cows in no less than six dairies and while his system strikes an outsider as involving needless complications, it is generally accepted as satisfactory'. Others were able to indulge in a bent for popular Victorian antiquarianism. 'The Rolls of the Manor of X have been searched and no statement or suggestion to the effect that the property in question is subject to such a Fine can be found.'

In another case in 1894 the Commissioners were obliged to value a Heriot which on the Rolls stood 'On the death of the Tenant leaving a Widow the Heriot shall be the Best Horse or Live Animal of which the Tenant was possessed and if no Livestock then the Best piece of Furniture'.

Another Commissioner reported on the poultry-cramming industry in Sussex. 'Poultry rearing tends towards early marriages as it enables young men by thrift and industry to save money quickly. It affords employment to women and children but unfortunately the fact that they can well look after the poultry sometimes enables an idle husband to "sweat" them and live on their exertions. The children employed on "stubbing" frequently do two or three hours' work before going to school and so come tired to their lessons.'

All in all, 1894 was a busy year. One can visualize the air of tired finality with which a Commissioner staying in a country inn wrote late at night by the light of a guttering candle on the back of a local valuer's claim 'Mr. Y has inserted the amount on the application but I am not aware how he arrived at it'. He went on, 'in concluding this hastily written report I beg to record that should further details be required I shall be happy to furnish them from my Memoranda'.

The worst of the depression was at hand as the year closed and 'Down Corn, Up Horn' would save the farming community from utter disaster. Change was in the air but the Commissioners would accept it and continue through many more radically altered conditions to bring their professional knowledge to the service of agriculture.

George Sigsworth
Agricultural Officer of the BBC

Radio and Television in Agriculture

IN its broadest terms, farm broadcasting on radio and television is simply another tool in the drive to alleviate world hunger. In the developing regions of the world, the aim is to stimulate action in the application of new farming techniques—perhaps a very simple action like the need to use a new strain of rice—whilst in more developed countries the emphasis is on economic and overall management considerations, with matters of husbandry being of secondary importance. It is for this reason that programmes should be planned in full co-operation with other agricultural organizations and not in isolation.

The main mass-media of press, radio and television, although in some ways competitive, are in effect complementary to one another. Throughout the whole field of communication each has advantages and special characteristics which should be exploited. The main advantage of the written word is its permanence. Radio and TV are transitory, but the written word can be read and re-read until the message is fully understood. The written word, however, is ineffective in countries where there is a high rate of illiteracy and where, in any case, the problems of printing and distribution are in themselves prohibitive. Radio and TV have similar characteristics except that the latter is more complicated, much more costly and at present much less widespread, especially in the developing countries. Of the £6 which we pay for a BBC licence, £4 15*s*. goes to TV and only £1 5*s*. to radio.

In the case of television, it is easier to hold the viewers' attention, and subjects can be treated in greater depth and in more detail than in radio. For this reason, programmes such as 'Farming', the BBC's weekly television programme, tend to treat one subject only, compared to the five or six items in the radio programme 'On your Farm'. But in some ways, and particularly in under-developed countries, radio has many advantages over television: with news, weather and market reporting, where speed and regularity of transmission are essential, radio has as yet no equal. The introduction of transistor radios has greatly facilitated reception; its operation requires only

a small number of technically trained staff; and a low power radio network such as the BBC's local radio stations, can cover a small specialized area of only a few square miles. Alternatively, radio can be linked to a vast chain covering huge continents such as the radio network of the United States.

In the BBC, farm programmes are regarded as service broadcasting. As such, they are planned to cater for special interest groups. In Britain, where agricultural development has expanded, the number of farmers is relatively small and does not comprise a large part of the total audience. Because of this we cannot transmit farm programmes at a peak time, and as competition for air-space increases, broadcasting to minority audiences becomes more difficult to justify.

In developing countries, where the majority of the population is still engaged in primary agriculture, a more favourable listening period may result. But the fact is, that in general, broadcasting concerns itself primarily with entertainment programmes which, because of mass-audience appeal, often receive priority in the programme schedule. Farm broadcasting, therefore, has to be carried out either in the early morning, during the midday meal time, or in the early evening. The choice of these times depends on the habits of the farming community, bearing in mind that one of the advantages of radio is that it can be listened to whilst eating a meal or carrying out farm work such as milking—hence the BBC's daily 'Farming Today' programme broadcast at 6.32 a.m.

In the case of radio, the time at which programmes are broadcast has a strong influence on their planning. As farmers tend to be doing other things at the same time as listening, short snappy items rather than long interviews or discussions are likely to be more effective. This is one of the main reasons why 'On your Farm' has developed its present format. This enables a wide range of items to be covered; it holds the listener's attention and it meets the needs of radio as being a medium in which the main advantages are immediacy and ability to arouse an awareness and interest in the audience. Radio is not a suitable medium for discussing a subject in depth, especially at the time of day that most farm programmes are broadcast.

Other than broadcasting information and advice to farmers, radio and television can be used to introduce improved agricultural practices. It may be through radio that a farmer first hears of a new method of spraying against a persistent weed. He may learn through television about disease control or prevention. At its simplest, broadcasting may be no more than a reminder to carry out some form of operation. The fact is, that through broadcasting the farmer can be made aware of new techniques and start to take an interest in them. He may even be stimulated sufficiently to seek more information elsewhere, either from his advisory officer, the local research station or even from a neighbouring farmer. One of the best ways of persuading farmers to adopt new ideas and techniques is through another farmer. This is particularly so in peasant communities where tradition and suspicion have to be broken-down. In most villages there is a recognized leading farmer, a pioneer, who, if interviewed in a farm programme about his methods and in particular his successes, can influence other farmers in the area more effectively than in other methods of approach.

For radio programmes to make their greatest impact, however, it is necessary to have some sort of follow-up action. Thus in many countries, farm forums, or listening clubs, have been developed. In some countries where

the only receiver is a village set, listening is perforce on a communal basis. In other cases, however, communal listening is desirable as it allows for further discussion which may go beyond the stage of informing the farmer, and lead to positive action. The need to stimulate action is one of the major problems facing both the advisory worker and the producer of farm programmes. If programmes are to give the maximum effectiveness, listening clubs and farm forums will greatly help in this direction.

Radio is not a self-sufficient medium, but when it is coupled with group reception and discussion and is assisted by a two-way channel of communication, experience in countries such as Canada and India has shown that it can be a vital factor in creating changes in traditional farm practices. A good example, to quote but one instance of the effectiveness of this type of farm broadcast, occurred in the Philippines a few years ago. Here, a campaign to introduce an improved strain of Japanese rice into the islands was so successfully popularized through radio that within six months the Government was unable to meet the farmers' demands for the new variety.

An interested group of overseas listeners

In addition to farm service programmes, rural programmes of a more general nature are often used both for entertainment purposes and also to introduce new ideas and modern techniques to the farming community. A country life serial, such as the 'Archers', has proved to be an extremely popular type of programme not only in Britain but in countries such as Australia, Canada and Jamaica. The Archers has now run for eighteen years, and at its peak before television, it had a daily audience of ten million people. It still has a daily audience of over three million people and another two million listen to the omnibus edition on Sundays. Farmers listen to the Archers not so much to learn something from it, but because they like to hear farming

topics and country life talked about. There is no doubt that the Archers has contributed a great deal to help town people to understand more about the farmers' problems and to bridge the gap between town and country. The Borchester Echo, the fictitious local paper which circulates in the 'Archer' countryside, and runs to half a million copies, always attracts a large number of letters from listeners who want to know the real-life location of Ambridge and Borchester. When Dan Archer announced that he had advertised for a farm worker in the Borchester Echo, the BBC actually received some thirty applicants for the job. Some of them with testimonials!

In recent years, television has become increasingly important in farm broadcasting. All the developed countries of the West broadcast regular programmes for farmers on a bi-weekly or weekly basis. In Japan N.H.K. broadcast one hour's TV farm programme every morning. In the developing countries TV is just starting but the cost of bringing it to the rural areas is extremely high. It seems likely that the first step in its introduction for farm broadcasting in developing countries will be the establishment of agricultural TV schools by providing receivers to village communities.

Television on an educational medium is becoming increasingly important in Britain. The BBC now run three special educational series dealing with dairy-husbandry, pigs and farm mechanization. A fourth series on farm management starts in the autumn. In several other countries, farm TV programmes are being broadcast in close association with the adult educational departments of the broadcasting organization and the Ministry of Education. The programmes are planned as part of the curriculum of farm colleges and are backed up with booklets and written background material which the student uses in conjunction with the programmes. Tutor's notes are also provided and in most cases exams are set at the end of the course.

These programmes, however, are not intended only for the student; they also aim to attract a large audience of farmers. Ideally, farmers should watch the programmes as a viewing group planned on similar lines to a radio forum. In fact, group-viewing under the guidance of an experienced extension specialist may be essential if farming programmes are going to be really successful. In developing countries where there is an acute shortage of schools and teachers, and where normal methods of communication are difficult, it seems that TV may well prove to be the most economical way of establishing education on a national scale.

Report on Farm Dairy Buildings

The 'Report of a Working Party on Farm Dairy Buildings, 1969' has just been published and is available from the Ministry of Agriculture, Fisheries and Food (Publications), Tolcarne Drive, Pinner, Middlesex. HA5 2DT., price 2*s.* 6*d.* net.

BRITISH AGRICULTURE
1894—2000

T. W. FLETCHER
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THREE-QUARTERS of a century ago, British farmers had been suffering from falling prices for almost twenty years. The Royal Commission on the Distressed State of the Agricultural Interest which had been appointed by Disraeli's government in 1879, that wet year notorious for foot-rot, recommended the creation of one public department for agriculture, and in 1889 the second Board of Agriculture was created, with 'Squire' Chaplin as its first President.

The new Board immediately began to issue pamphlets, but by 1894 its accumulation of information needed a wider outlet. In a 'statement of intent' in the Introduction to Volume I of the *Journal of the Board of Agriculture* published in September, 1894, the Board explained its aim thus: 'With the double object of providing a suitable channel for giving publicity to such information, and securing a medium for systematically recording certain statistical and other intelligence . . . the Board has deemed it desirable to issue a quarterly Journal'.

A more inauspicious time could scarcely have been chosen. Anxiety at the renewed fall of wheat and barley prices in 1892 was exacerbated in the south and east of England by the severe drought of 1893, and in 1894 the price of wheat tumbled to its lowest level since official Corn Returns began in 1771. In the very month that the Board's Journal appeared, wheat fell from 24*s.* to under 19*s.* a quarter: in the mid-seventies it had sold at 55*s.* and more. But the Board was undaunted: the contents of the first volume included The Cost of Growing Wheat in U.S., Agricultural Co-operation in France, Poultry Rearing in Russia, Dairying in Victoria, Crop Prospects Abroad—distilled from original, foreign sources, Injurious Insects and Fungi, Extracts from Diplomatic and Consular Reports, Parliamentary Publications Dealing with Agriculture and many statistical series reprinted from the *Agricultural Returns*.

The prevailing 'free-trade' ethos restricted the implementation of the recommendations of the second Royal Commission on Agriculture set up in 1893 by Gladstone's last government to a measure of de-rating. Consequently the energies of the Board were directed towards the technical education of the farming community, and in this activity the *Journal* played a significant part and one which has remained of central importance ever

since. Thus the private initiative exemplified by the Royal Agricultural Society with its motto, 'practice with science', was reinforced officially, with results in the twentieth century far exceeding the most sanguine of Victorian expectations.

Continuity and tradition, however, always typify the agricultural scene. In contrast, what to the historian, are the most significant changes during the last seventy-five years and what can be hazarded about the future?

Firstly, come the obvious changes in technology. Regional differences in agricultural practices in 1894 were extreme. Whilst the Royal Shows at Cambridge in 1894 and Darlington in 1895 exhibited spraying machines, oil engines, FYM spreaders, balers and milking machines, the scythe, the sickle and even the flail were in common use. Man and horse were still the prime movers and in the remoter parts of these islands the horse took second place to man—and woman. The geographical spread of new technology was slow until the scientific revolution of the last thirty years. Today, electricity, the milking machine, the tractor, the baler and combine are well-nigh universal, and the chemical analysis of soils, feedingstuffs and fertilizers is widely understood. In the future, regional differences may be expected to diminish further, except perhaps in the more physically extreme environments such as the hills of the north and west where the shepherd and his flock still reign, albeit strongly challenged by the Forestry Commission. But change may come. Not only our poultry, pigs and beef but even our lamb may soon never have grazed a green sward before being packaged for the supermarket and the deep freeze.

The second category of change concerns the farming community, the most marked being the well-documented fall in the number of farm workers. From a million in 1891 to 342,000 'regular whole-time workers' in 1966, the decline has been continuous. Since the last war, ever increasing capitalization and the high wages offered by an affluent, urban, full-employment economy have sucked labour from agriculture, and it would be a bold man who dared assert that the outflow is about to cease. In contrast, the number of farmers has, until the amalgamations of recent years, remained remarkably stable, although the break-up of the large estates has led to an unprecedented increase in the proportion of owner-occupiers to all farmers from 14 per cent in 1890 to 50 per cent in 1960 in England and Wales. In Scotland, tenants still constitute a majority. The decline of the landowner was perceptible at the end of the nineteenth century, politically with the extension of the franchise and economically with the agricultural depression. The Royal Commission of 1879 was chaired by the Duke of Richmond, 'the farmers' friend', and until the eighties the leadership of the Agricultural Interest was a prerogative of the aristocracy in the House of Lords and the Privy Council. But the Commissioners of 1893 were mainly commoners and a conflict of interest between landlords and tenants became apparent. The shock of Harcourt's innovation of 'death duties' in 1894 was extreme; in Lady Bracknell's words, the ownership of land had 'ceased to provide either pleasure or profit'. From 1889 onwards, the growth of the Agricultural Department in Whitehall was paralleled by organizations of tenant farmers which culminated in the crucial role played by the N.F.U. during and after the last war. The time is perhaps ripe for further development.

A third significant change since the nineteenth century which no one today could envisage reversing, is that from *laissez-faire* to central planning.

Harassed by the submarine in 1914–18, the depression of the thirties and the World War of 1939–45, successive governments have intervened ever more actively in all aspects of agriculture and, since the endorsement of Keynesian full-employment by both parties in the last two decades, planning has clearly come to stay. Debate in the future will undoubtedly turn on the precise forms which planning should take. Closer co-operation between government departments with the aim of minimizing the pursuit of incompatible ends will be expected. Nowhere will this be more rewarding than in the complex field of land-use in which agriculturists are vitally interested and in which the urban electorate is becoming increasingly concerned. Internationally, involvement will develop irrespective of the Common Market. The problems of world food surpluses and deficits cry out for solution.

Fourthly, there are changes associated with the rise in status of the economist in the twentieth century. The 'social' concerns of the pre-1914 Agricultural Interest—and its critics—still centred around the age-old question of a 'sturdy peasantry, its nation's pride' and the demand for a stake in the land was heard even after 1918. But the depression of the late nineteenth century focused attention on the economics of farming, on prices, costs and profits. The foundation in Oxford of the Research Institute of Agricultural Economics in 1912 was a herald of the new age: farming was no longer to be a 'way of life'—the cash nexus was all. Economic forces were seen as immutable and scientific progress as evermore inspiring. Men must leave the land to maintain the incomes of those who remain and, as a corollary, 'science' was to be translated into profitable practice regardless of long-term hazards, scientific or sociological. The 'dismal science' had found a fertile field to cultivate.

Can this attitude, this set of beliefs, not unduly caricatured, be considered adequate to deal with the complex social problems that will face British society and its agriculture in the coming decades? In the last seventy-five years British agriculture has pursued a path of economic efficiency to an extent that Europe may envy and industrialists might emulate. The impressive record exemplified by the Marketing Boards, the War Agricultural Executive Committees and the N.F.U. has been matched by the achievements of the Ministry in its advisory services, its research and its education. But is it sufficient, when looking into the future, to anticipate that existing trends and progress may be maintained? Are there not already signs of rigid attitudes and of specialization so narrow that the wood cannot be seen for the trees? The growth points of the future are overlaid at any moment in time by the weight of tradition and the pressure of the immediate but, looking around in 1969, is not the most significant portent for the future the growing concern at the impact of affluence, of scientific progress and of population growth on the human environment?

The pressure to reduce costs in British agriculture will assuredly continue, and just as certainly the consequent technological innovations will invoke growing criticism from the all-powerful urban electorate on two counts. Firstly, there is the continuing criticism of the quality of food produced on farms and of the methods employed in its production. Secondly, there are the proliferating problems of 'amenity' and conservation. Shaw-Lefevre, the chairman of the 1893 Royal Commission, successfully urged that agricultural enclosure should make provision for open spaces to refresh the minds and bodies of the teeming town dwellers. Epping Forest is a memorial to his

foresight. This urban majority, with ever-increasing affluence, leisure and motor cars, will make ever more pressing demands on agricultural land and its resources. Britain's countryside has been made by farmers and it can be unmade; grants for the removal of hedgerows are but one of the more obvious ways in which economic and scientific considerations clash with the long-term expectations of the community. And the demands on natural resources by industry, both public and private, in its ignorance or disregard of the essentially symbolic relationship between man and his environment, as understood by old countrymen and new ecologists, are escalating.

Seventy-five years ago, the Board of Agriculture grasped the nettle of agricultural depression and encouraged technical education on a laudable scale in an era of *laissez-faire*. The precedent is irresistible. Education is still needed, but should it not be infused with a new, humane or ecological content, and addressed to a wider public? Can we hope that by 1994 the Ministry of Agriculture will have given a lead not only to the farming community but to its fellow departments, and that the centenary will be an occasion on which the whole community will pay tribute to the foresight and imagination of a Ministry that transcended its brief—as it surely has done in the past?

Annual Report on Safety, Health, Welfare and Wages in Agriculture, 1968

A report on safety, health, welfare and wages in agriculture covering the period 1st January to 31st December, 1968, is now available.

Copies of the Report may be obtained from H.M. Stationery Office (addresses on p. 478) or through any bookseller, price 2*s.* 3*d.* (by post 2*s.* 7*d.*).

The Report gives an account of proceedings under the Agricultural Wages Act 1948 as required by Section 13 of that Act; and the Agricultural (Safety, Health and Welfare Provisions) Act 1956 as required by Section 21(1) of that Act. It also includes an account of proceedings under the Agriculture (Poisonous Substances) Act 1952 since this is designed to protect agricultural workers against hazards arising from their employment in the same way as the other Acts.

The Report shows that the number of accidental deaths on farms in England and Wales during 1968 was 114, the same as in 1967. The number of children killed was 16. The principal cause of death was the overturning tractor, with 32 deaths, but this figure would undoubtedly have been higher had it not been for protection given by safety cabs, which many farmers are fitting voluntarily in advance of the Regulations. No deaths of workers from contact with pesticides or veterinary products were reported during the period under review.

In recognition of the unique success which has brought British farming out of the depression of the 1890s to the vigorous industry it is today, this article is offered to all

WHO SERVE THE LAND

S. R. O'Hanlon, M.B.E.

ANNIVERSARIES are commonly accepted as being a time for looking back along the road we have come, for taking stock of present circumstances and laying down guide-lines for the future. Such a moment is now, when the Ministry's journal, *Agriculture*, is 75 years young. We look at the vast complex of Britain's agricultural industry as it is today, turning over annually, with an exemplary degree of increased productivity, close on £2,000 million and compare it with its debilitated state in 1894—a discarded poor relation of the industrial *nouveau riche*. No period in our history has been marked by such dynamic changes in political, social and commercial life as the past three-quarters of a century. By communication and education the country has within that time been shaped to an economic whole. Enclaves of prejudice and ignorance which had their roots in isolation have disappeared. In their place an integrated community has been increasingly served by the gathering momentum of scientific progress and technological improvement.

Years of depression

No comets heralded the birth of the quarterly Journal of the Board of Agriculture in September, 1894, five years after the Board had been established. Indeed the timing of its publication could hardly have been less auspicious, since it coincided with the period of the deepest depression home agriculture has ever known. The price of wheat, the axis on which the farm world then turned, had fallen to a beggarly 22*s.* 10*d.* a quarter; whole areas in the West, Midlands and North had reverted to grass, and in face of the cargoes of frozen meat which continued to pour in from Australia, New Zealand and South America, there was no incentive to turn appreciably to livestock production in an attempt to arrest the paralysis which was creeping throughout British agriculture. Farm workers, understandably following the popular line of *sauve qui peut*, left the land in their thousands to seek employment in the towns or a new life overseas. The blaze of imperial glory that bathed Queen Victoria's diamond jubilee three years later did not touch the rural heart of England. But faith was not lacking in the less frequented corridors of power, and a new journal, government sponsored, as a medium to disseminate information on farming problems and research work at home and abroad, was clear evidence of this.

Assessment of leaf rust diseases on wheat plants at Jealott's Hill Research Station

Throughout the previous century scientific inquiry had been probing deeper and deeper, discovering new techniques, better breeding of livestock and more efficient tools to put into farmers' hands. The names of the experimenters and improvers are legion. And if the latter part of the nineteenth century was to leave the average farmer becalmed in the economic doldrums, the spirit of scientific inquiry was unabated. That great agricultural society, the Bath and West, had been founded in 1777 for the encouragement of agriculture, arts, manufactures and commerce, the Highland Society of Scotland seven years later, the Yorkshire Agricultural Society in 1837 and the Smithfield Club in 1798, and the Royal Agricultural Society of England, which began as the English Agricultural Society in 1838. Of a quite different character, the Farmers' Club, conceived out of the political discrimination against tenant farmers at that time, was formed in 1842 to become a forum for the exchange of views which made, and have continued to make, many a notable contribution to progressive farming thought. Rothamsted Experimental Station, the oldest agricultural research centre in the world, had been started in 1843 by John Bennet Lawes who, in collaboration with Henry Gilbert for over half a century, initiated the fertilizer industry upon which farming rests so heavily today.

The National Fruit and Cider Institute, later to become Long Ashton Fruit Research Station, was set up in 1903, and the Plant Breeding Institute of Cambridge, arising out of Sir Rowland Biffen's work which he had begun in 1899, was opened in 1912. By the early years of the twentieth century agricultural education was beginning to move swiftly on a parallel course. What was needed now were efficient channels of communication to bring the concepts of a new farming order into the fields and translate new ideas, new methods and new materials into a thriving agricultural industry. Political myopia, two world wars and the economic buffeting of their aftermath delayed its growth, but the foundations were there and men were not lacking to build upon them, promote further research and experimentation and, what it all comes to in the end, applying the findings in the field.

Resurgence

Today our farming industry can manifestly be seen to have taken its rightful place in the nation's economy, producing half Britain's total food require-

ment (two-thirds of all that can be produced in the temperate zone) and feeding a population that has increased by 17 million since the turn of the century to a figure of 55 million; and that on less land and with a farm labour force that has been diminishing in recent years at the rate of 25,000 a year. Behind this result, aggregating from some 430,000 holdings, more than half of which are part-time, can be seen a vast network of services supplying and carrying the life-blood of progressive agriculture. From the giant manufacturers of farm machinery, chemicals, fertilizers, feedingstuffs, farm buildings and an enterprising sector of seed firms down to the smallest agricultural merchant (often not more than a family business); equally the staffs of research laboratories working in a hundred or more disciplines, the veterinary profession and advisers on all aspects of farming from the initiation of an enterprise to farmgate sale; the resources of the countrywide organization of the N.A.A.S., with its two dozen experimental farms and stations, and the services of the A.L.S., that can be mobilized by any farmer for the cost of a letter or a telephone call; a local weather forecasting service supplied by the Met. Office through a chain of stations; and the various marketing boards: all serve the land.

Then there are those men (and women) who serve only to write—the Press. There is not another industry in the country which is served so well by the written word. Where once cattle market reports and the odd local farming incident were (between weddings) regarded by editors as giving sufficient attention to the farmers' lot and were merely assignments for cub reporters to cut their milk teeth on, today the national and local Press alike have their specialist correspondents and contributors. From research and experimental stations, including a wide and important range of commercial establishments, professional journals, trade magazines and announcements, to say nothing of Government schemes and a plethora of legislation, a wide river of paper, always seeming to be in spate, flows in the agricultural journalists' direction. As change follows change with bewildering rapidity, they need to be more than ordinarily knowledgeable of their subject in order to

Perspex rings with electric heat barriers to prevent escape of aphis from broad bean plants treated with experimental insecticides at Jealott's Hill Research Station

weigh the relative values of this material, to judge what is newsworthy and then often to translate the esoteric language of the original into the vernacular of everyday farming!

But if the national and the provincial coverage of farming affairs is now immeasurably better than once it was, the palm must be awarded to the specialist farming weeklies and monthlies whose reporting, informative articles, personal stories and critical comment keep the complexities of modern farming in sharp focus. Of these, the *Farmer and Stockbreeder*, which evolved from the mid-nineteenth century through several metamorphoses to its present form and title, may claim to be the most senior. Evidence of pride of craft among agricultural journalists is never far to seek and indeed inspired the formation of the Guild of Agricultural Journalists soon after the second world war, with Sir Richard Haddon as its first Chairman.

Agricultural shows, both those of the big societies and more modestly those at county level, which played so important a role in fostering farming interests and promoting technical improvements, are a happy, if tiring, hunting ground for the journalist in search of copy; so too are the many conferences and demonstrations that challenge cherished ideas and inject new ones. Radio and television, each calling for new expertise in sound and visual 'journalism', have added enormous value in communication, and with the wider use of colour television we may, I hope, see an extension of farming programmes in that field. It should not be thought that such programmes appeal only within the limited province of farming folk. In our modern, integrated society the former shortsighted division between town and country interests and attitudes is steadily partaking of the status of the dodo.

Then and now

In the early issues of this Journal, which incidentally assumed monthly publication in April 1904, and the title of *Agriculture* in April, 1955, attention was being focused on American, continental and colonial practice and experience rather more than on home aspirations and achievements; thus, the cost of growing wheat in the United States of America, poultry rearing in Russia, dairy farming in Australia, the frozen mutton trade of New South Wales and sheep breeding in the Falkland Islands. A 'new' industry was reported to be opening up in France to supply S. American sheep farmers with a nicotine insecticide. Reflecting a reduced demand for harvest labour, fewer Irish labourers were reported to be coming into the country (quoted as 22,420 in 1894, compared with 27,050 two years earlier).

By contrast, *Agriculture* today mirrors the unparalleled progress of a silent but fundamental second revolution in British farming thought and practice which employs every scientific and technological aid that a multitude of skilled men and women in laboratory, university, college, workshop and field are manipulating to a common purpose. The economic pressures and changed social habits which have stamped their impress on the second half of the twentieth century may confidently be expected to continue, but we can be equally confident that their challenge will be answered. To all who serve the land we dedicate the future.

in brief

- **Wrest Park revelation**
- **Eggs from hen to housewife**
- **Guide to statistics**

Wrest Park revelation

OPEN Days at Wrest Park, the focal cell of that hive of ingenuity known as the National Institute of Agricultural Engineering, is like an invitation to explore Aladdin's Cave. There seems to be no end to the wealth of imagination that is brought to their researches in pursuit of removing time-consuming and routine farm drudgery, improving performance of established mechanization and increasing safety factors. The pattern of farming that is emerging for the 'seventies is of fewer man-hours in relation to higher productivity. More and more run-of-the-farm work will be assigned to automation, the electronic eye and the computer; and increasingly instrumentation will come to the rescue of human fallibility.

To take one example, the chores of the cowshed such as udder washing, the make up and feeding of individual rations, attention to milking-machines and moving the animals around may well be fully automated in foreseeable time if the present promise of N.I.A.E. research is fulfilled. Batch weighing will become a thing of the past when work on a weighing conveyor, already well advanced, is finalized. Where once the comfort of farm workers was not held to have a particularly high priority, the attention now being given to ergonomics at the Institute augurs well for the future and incidentally the attractiveness of farm work.

Another example is the automated feeding of silage and rolled barley, plus minerals, weighed, mixed and channelled to selected mangers, which has been tried out at the Bridget's E.H.F. Conventional timber or sheet metal ducting for livestock buildings, besides being unnecessarily heavy, is now appreciably expensive, and therefore the perforated polythene inflatable ducting of 500 gauge lay-flat tubular film adapted by the N.I.A.E. will commend itself as an economic approach to the ventilation of long houses. The expense and difficulties, too, that are notoriously attendant on top fruit picking have also been studied by the Institute. Thus the orchard mobile which allows pickers to work from an adjustable, self-raising platform has already shown itself to be a very worthwhile approach, especially since it can equally well be used for pruning. If an example is needed where imagination (rather than necessity) is seen to be the mother of invention, a visit to Wrest Park will assuredly provide it.

Eggs from hen to housewife

QUALITY in eggs is something we have come to take for granted, which in itself is a testimonial to breeders, producers, marketing organization and retailers alike. The older generation will remember that none but the foolish cook or carefree optimist would think of breaking an egg direct into a prepared mixture. They will

also recall the not infrequent experience of the boiled breakfast egg that turned out to be highly charged with sulphuretted hydrogen! This, however, is far from saying that perfection has been reached. It is a common complaint of the modern housewife that the shells are too thin and crack open on boiling, the whites are often watery and the eggs therefore condemned as old, and the presence of blood and meat spots that have escaped the candling monitor are an affront to hygiene.

It should be more widely known amongst consumers that the production of perfect eggs for a mass market is fraught with many difficulties that start with genetics in the breeders' world and continue to harass the production and distribution chain all the way from point of lay to point of sale—to say nothing of wrong storage once the eggs are in the home. We know, for example, that the incidence of defective shells increases with the age of the laying bird, due to metabolic changes that do not allow complete absorption of essential materials. We also know that thin whites are frequently a heritable characteristic and that feeding has little, if any, effect on their consistency, but proper handling and storage play a greater part than is generally realized. Disease, e.g., infectious bronchitis, must also share the blame and underlines the importance of routine vaccination of laying stock.

The housewife has perforce to buy her eggs as an act of faith—faith in their freshness. And that implies frequent collection on the farm (especially from deep litter houses) and keeping the eggs cool—around 55 deg. F—at every subsequent stage.

Guide to statistics

'THERE are three kinds of lies: lies, damned lies and statistics.' This condemnation, attributed to Benjamin Disraeli, of a scientific study which has gathered momentum and perforce widened its coverage with the increasing complexity of social life since his time, is still very much in the forefront of the popular mind—especially if the findings tend to prove something different from what is believed to be true! And since statistics are often the herald of policy, whether officially or commercially applied, there is all the more reason why the sources of information from which the figures are collected and examined should be made widely known, rather than that they should seem to emerge from some shadowy, even unknown, origin.

In agricultural production and food consumption and distribution, with all their present-day ramifications, the need to proceed under statistical signposting becomes more and more apparent every year. Thus the Ministry's publication of *A Guide to Official Sources of Agricultural and Food Statistics* (H.M. Stationery Office, price 12*s.* 6*d.* (by post 13*s.* 2*d.*)) reveals the exploration of a diversity of regular series, comprising primary production including fisheries, utilization, food supply, consumption, nutrition and personal expenditure on food.

Properly viewed, such information, painstakingly assembled and sifted, adjusted for factors that could bias the figures, and subsequently analysed and interpreted, is fundamental to the well-being of a growing population and the changes in industry and economic life. Carlyle was probably nearer the truth than Disraeli when he remarked that 'the judicious man looks at statistics not to get knowledge, but to save himself from having ignorance foisted on him'!

AGRIC

Books

A Little History of Exmoor. HOPE L. BOURNE. Dent and Sons, 1969. 40*s*.

In an age when so many things are taken for granted, and so little thought is given to the past, it is refreshing to read an account of the events and developments which have influenced the moulding of a piece of rural England famed for its scenery, its agriculture and its individuality. Written in a sincere and easy style, and beautifully illustrated with nine line drawings by the author, this book traces the comings and goings of the human race in the Exmoor hill country from the hunters of the Stone Age to the beginning of the present century. Each era is faithfully depicted. Pride of place is taken by events leading to the tyrannical days of the Royal Forest and those associated with the great land reclamation of the Knights and others.

Throughout the work runs a constant reference to the relationships between events of yesteryear and present-day places and practices. This link makes the historical accounts live in the present and, on this score alone, grips the reader's imagination and interest in every chapter. For those who are not familiar with the terrain, the addition of a sketch map appendix would have been welcome. It is also disappointing to those who have known Exmoor during the last half-century that more has not been written about the latest agricultural and social revolution in these parts in the last three decades. Still a wild, unspoilt, countryside of hill and coombe, the Exmoor of today deserves better recognition.

These criticisms are trivial compared with the wealth of information and pleasurable reading. For agriculturist, tourist, forester and stag-hunter, and the countless other thousands who love and enjoy rural life, this new history of Exmoor is a welcome addition to any bookshelf. The author deserves nothing but praise for producing such a detailed and delightful story of the West country hill-tops 'above the Severn Sea'.

P.H.

Wildfowl Management on Inland Waters. ELEY GAME ADVISORY STATION, 1969. 4*s*. (including postage).

Encouraging wildfowl to live and breed on inland waters is interesting many people at the present time. Although the usual motive is to encourage wild life, this leaflet shows how good sporting can be had as well. Packed tight into eighty pages is a wealth of information on the basic requirements of various sorts of wildfowl that live in our inland ponds, lakes, gravel pits and rivers. It describes the method of building up a population of healthy birds making the best use of existing stretches of water or starting from scratch. Dam construction, pond digging (including the use of explosives!) suitable aquatic plants (at the margin, emergent and submerged) are dealt with fully and there is a particularly carefully detailed section on breeding and rearing.

Sporting rents are often well worth having particularly at the present time and no doubt many more stretches of water could be more deliberately used for a colony of wildfowl. The booklet has a little jargon of its own—'mallard dynamics' is one paragraph heading—but those familiar with the style of the authoritative leaflets from the Game Advisory Station will welcome this latest production for the comprehensiveness and clarity we have come to expect from them.

R.G.A.L.

Biodeterioration of Materials. Edited by A. H. WALTERS and J. J. ELPHICK. Elsevier, 1969. £12. 10*s*.

This volume contains the collected papers presented at the first International Biodetermination Symposium held in Southampton in September, 1968. As a result of the very wide range of fields covered, it is extremely difficult to review satisfactorily this diversity of subjects.

Some idea of the fields covered is given in the first four papers delivered which dealt with the more general aspects of biodeterioration. The main emphasis throughout the symposium would seem to focus on mycological attack of all materials both natural and man-made, and the research that is in progress into the various methods of combating this attack.

From the purely agricultural point of view there is little that has immediate application, but, on the other hand, there is a great deal

of information on methods and techniques which could well prove of considerable use to both the research worker and adviser in their search for answers in the field. Leaving on one side the papers dealing with metal and glass deterioration, there is a great deal of very valuable information regarding the breakdown of cellulose and other carbon containing substances. This information could prove very useful in the study of the deterioration of stored products such as food for both human and animal consumption.

There are a number of papers dealing with the formulation and testing of fungicides and a very full picture is given of the controls on toxicity and effectivity exercised by a number of foreign governments. The non-metallic organic fungicides and the organo-metallic preservatives are dealt with at some length and although the treatment of these subjects is inclined to be academic, the possibilities of their application in fields, other than those mentioned in the papers, is worth serious consideration.

The effect of residual biocides on subsequent processes is high-lighted in a paper on wine making in which the effect of the residues of a number of biocides are shown to have a very dilatorious effect on the fermentation processes. In emphasizing the need for care in the use of these materials the author states 'It is remarkable that so few tragic incidents have resulted from the continued use of large tonnages of pesticides on crops intended for human food'. The following paper deals with moulding of cocoa beans and lists the mould species isolated. It is disquieting to note the number of these isolates which belong to species that are known to be able to produce toxic metabolites. This is being investigated, and the author states that to date aflatoxin had been demonstrated in the beans.

This volume is a valuable reference work for all persons involved in the preservation and conservation of everything from battleships and buildings to buses, from tall trees to the proverbial mustard seed.

J.H.

Plague on the Cheshire Plain. Edited by H. HUGHES and J. O. JONES. Dennis Dobson, 1969. 21*s*.

This small book has been written by the Assistant Editor of the Chester Chronicle, with help from the Editor and the Agricultural Correspondent and with the stated dual objectives of ensuring that 'it must not happen again' and for 'history'. The book is unlikely to have much effect on the attainment of the first objective but as a piece of history it is of interest and value, especially the section (46 pages out of the total of 109) which lists the names and addresses of all the stricken farmers, together with details of the stock they lost.

When the authors are narrating the unhappy events of the winter of 1967/68 in Cheshire, they hold the reader's attention and evoke his sympathy, but when they resort to quotations from contemporary speeches and statements they seem to have been somewhat unfortunate in their choice. It is a little disturbing to think that the authors appear to see nothing particularly unusual in a recommendation to use 'homeopathic borax' as a preventive against foot-and-mouth disease—or even a liberal supply of onions strung around the buildings.

Chapter three is entitled 'Praise for the men in the field; none for the High Command'. The men will naturally be grateful for the praise but they will be the first to pay tribute to their own High Command which gave them all the support they required during the epidemic. The main criticism levelled at the High Command appears to be that they did not do enough to curb the activities of the human population, but the epidemic of 1967/68 merely confirmed what informed veterinary opinion had always believed—that local spread of infection is normally over the hedges and not necessarily through the gates.

A.W.

Agricultural Extension. DONALD B. WILLIAMS. Cambridge University Press, 1969. 83*s*.

Professor Williams has had personal experience with the extension services in America, Britain and in Australia, his own country. His book clearly describes the history, growth and present structures of the respective extension services.

In the first section of the book the author deals with the American extension service, approving strongly of their structure and organization, the roots of which were established through the land grant colleges. He high lights the existence of legislation and written memoranda of agreement that defines the purpose of extension, and the

respective responsibilities of the Federal, State and County agencies. He traces how the U.S.A. extension specialists have, over the years, fulfilled an important leadership role and infused into their service a problem-solving purpose which is, apparently, lacking to some extent in the Australian system.

Of Britain he writes a most interesting account of the history and development of extension from the early days of 1889 when, under the Technical Instruction Act, local education authorities were empowered to provide technical instruction which included agriculture. He describes the various changes that have taken place as a result of either farming and government need or the reports of committees of investigation, that over the years have examined education and extension in Britain. The N.A.A.S. organization and its role are fully discussed, together with the problems that confront it in a developing and dynamic industry.

Finally, there is a comprehensive review of Australian research, extension and administration. Professor Williams comments on the problems besetting the Australian authorities in developing extension work in a continent that is seeing a very rapid growth in agriculture and industry.

In his conclusions he poses many pertinent questions on the concept of an extension service, the role of its staff, and the future changes that are needed to meet the needs of a progressively educated, dynamic farm and rural society. Obviously, he is more concerned with this problem in Australia but the questions are apposite to America and Britain.

Extension workers will enjoy reading this book and many will note the suggestions for better advisory programme planning and clear objectives, thus helping the farmer to reach sound management decisions and applying sound technical practice to meet the challenge imposed by increased productivity.

A.J.B.R.

Physico-Chemical and Biophysical Factors Affecting the Activity of Pesticides. Society of Chemical Industry, 1968. 90*s*.

The proceedings of the Pesticides Group of the Society of Chemical Industry's symposium, held on 10th-12th April, 1967, have taken about eighteen months to publish but, for the specialist, this volume has been worth waiting for. The twenty-two research papers from the five sessions cover the penetration of insecticides into insects and vertebrates, the kinetics of insecticide activity, penetration and transport in plants and the activity of herbicides.

All the papers are of a high standard and useful contributions to the subjects. Some, however, are completely mathematical and are not for professional agriculturists let alone farmers. Compartmental analysis is currently very fashionable and mathematical models are presented in this book for the kinetics of insecticide action (Cryer), for the kinetics of lethal effects of pesticides (Courshee) and for the accumulation, distribution and elimination of organochlorine insecticides by vertebrates (Robinson and Roberts). Relating these models to practical results, however, offers many difficulties and it is probably not desirable to search too hard for simple models to fit what are, in reality, very complex situations.

To attempt to review any of the individual papers here would do less than justice to the authors, each an expert in his own field. That they were originally well received is evident from the considerable discussion which follows some of the papers.

The volume is well-produced and well-edited, but its value is undoubtedly for a specialist and it is unlikely to find its way on to the average bookshelf.

J.A.R.B.

Library Guide to Agriculture and Horticulture. (2nd Edition). K. W. NEAL. 1969.

Mr. Neal has compiled this book for farmers and growers and it includes sections on book selection; purchasing and borrowing; points to note on subject coverage and style; notes on reading and note-taking. There are sections on libraries and their use and availability; on bibliographies, directories and other basic source material; as well as on statistics, periodicals, patents and British standards. Hints on fact-finding, writing an essay, further reading and a useful variety of addresses conclude a compact and very selective summary of information in two broad subject fields in only twenty-eight pages!

Copies of the booklet may be obtained from the author at 7 Church Road, Wilmslow, Cheshire, SK9. 6HH. Price 6*s*.

F.C.H.

Pests of Rice. D. H. GRIST and R. J. A. W. LEVER. (Tropical Science Series). Longmans, Green, 1969. £7 10*s*.

Rice yields vary enormously in different parts of the world: from upwards of 2 tons per acre in southern Europe, Japan and Australia, to as low as 7-8 cwt per acre under low standards of culture in equatorial regions. While climate and cultural conditions have a great influence on rice yields, there is no doubt that pests and diseases can —and often do—limit productivity. In this day and age many of the pests can be controlled culturally or chemically, and Grist and Lever have made a point of describing not only the nature of the damage done by each pest species, but also how to control it, when controls should be applied and, in many cases, indications of the responses that can be expected from treatment.

The book has seventeen chapters, starting with an excellent summary of the morphology and cultivation of rice and continuing with a general chapter on the classification, ecology and cultural control of rice pests throughout the world. (This appears to be the first book devoted to rice pests throughout the world, although there are many publications dealing with specific pests found only in limited areas). There follow chapters on pyralid and noctuid stem borers, other lepidopterous pests, plant bugs, beetle, fly, and miscellaneous insect pests. There are chapters on storage pests, and on the protection of rice and paddy in storage, and the final two chapters are devoted to non-insect invertebrate pests and to vertebrate pests. The twenty-eight black-and-white, and four colour plates are mostly of excellent quality.

The book ends with five appendices, including tables of application rates of insecticides, field equipment and safety precautions, conversion factors and abbreviations, and a check list of the main cereal and grass hosts of rice pests. The bibliography covers 647 papers, mostly published in the last fifteen years. The first part of the index arranges the pests alphabetically by latin binomial, and includes information on synonyms; insects studied in detail have their names indicated in bold type, while those only briefly mentioned in the book are indicated in ordinary type: 822 species and sub-species are mentioned, and 197 of them are in heavy type. The second part of the index covers general topics, including parasites and predators and the common names of the pest species.

Overall, this is an excellent book with remarkably few faults: one, which many may regard as minor, is inconsistent use of metric and non-metric measures—the reader is sometimes confused in turning suddenly from oz per gal to cc per gal, and and from lb per acre to kg per hectare. Another is in the inconsistent use of common and trade names for chemicals: carbaryl is sometimes cited as Sevin, trichlorphon as Dipterex, and so on. But these points in no way detract from the undoubted value of the book, which deserves study by all who are concerned with rice.

A.H.S.

books received

The Logic of Orchard Replacement. R. R. W. Folley. Copies from the Dept. of Agricultural Economics, Wye College, Ashford, Kent. 6*s*. (including postage).

Economics of Pig Production. (Agricultural Economics Report No. 65). R. F. Ridgeon and F. G. Sturrock. Dept. of Land Economy, Cambridge University. 19 Silver Street, Cambridge. 7*s*. 6*d*. (including postage).

Occupational Immobility of Small Farmers. (Occasional Papers No. 13). Ruth Gasson. Farm Economics Branch, Dept. of Land Economy, Cambridge University. 5*s*. 6*d*. (including postage).

Dairy Produce. A Review of production, trade, consumption and prices relating to butter, cheese, condensed milk, milk powder, casein, eggs, egg products and margarine. The Commonwealth Secretariat. 30*s*. (by post 31*s*. 6*d*.).

Industrial Fibres. A Review of production, trade and consumption relating to wool, cotton, man-made fibres, silk, flax, jute, hard fibres and other hemps, mohair and coir. The Commonwealth Secretariat, Marlborough House, London S.W.1. 40*s*. (by post 42*s*.).

Profitability of Farming in the North of England, 1967–68. Results for Selected Groups of Farms. Report 172 F.M. S. Robson. University of Newcastle upon Tyne. 3*s*. 6*d*.

Annual Report 1968. Pea Growing Research Organisation Limited. Price to non-subscribers: 10*s*.

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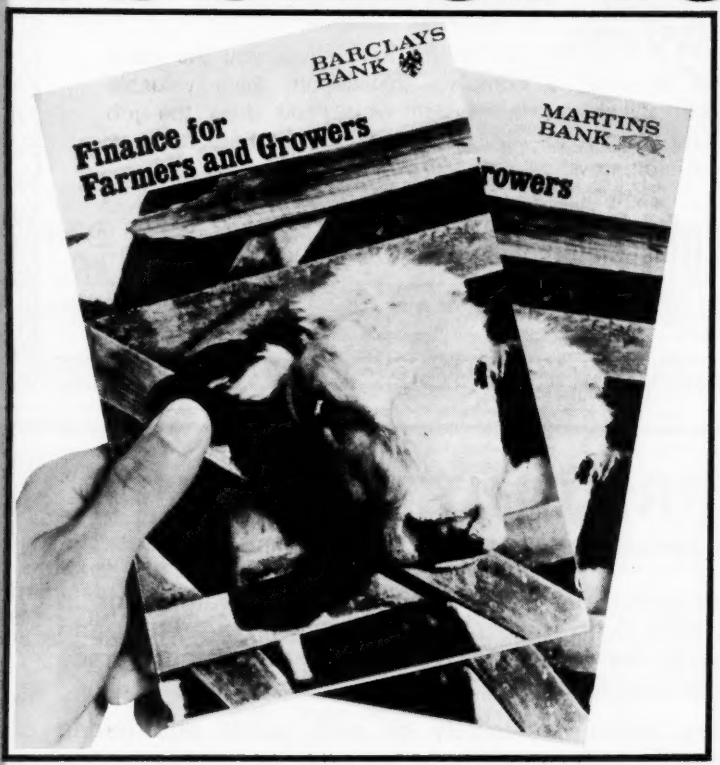

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